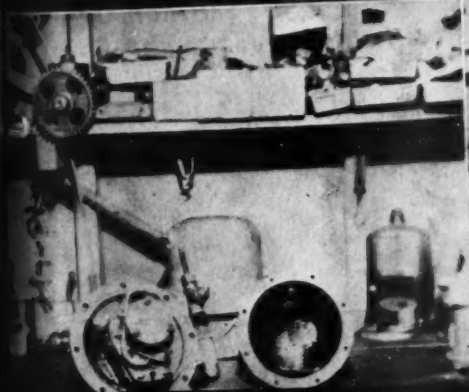


# The Refrigeration Service Engineer

JANUARY • 1939

Vol. 7  
No. 1



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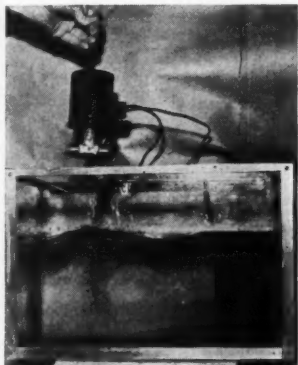
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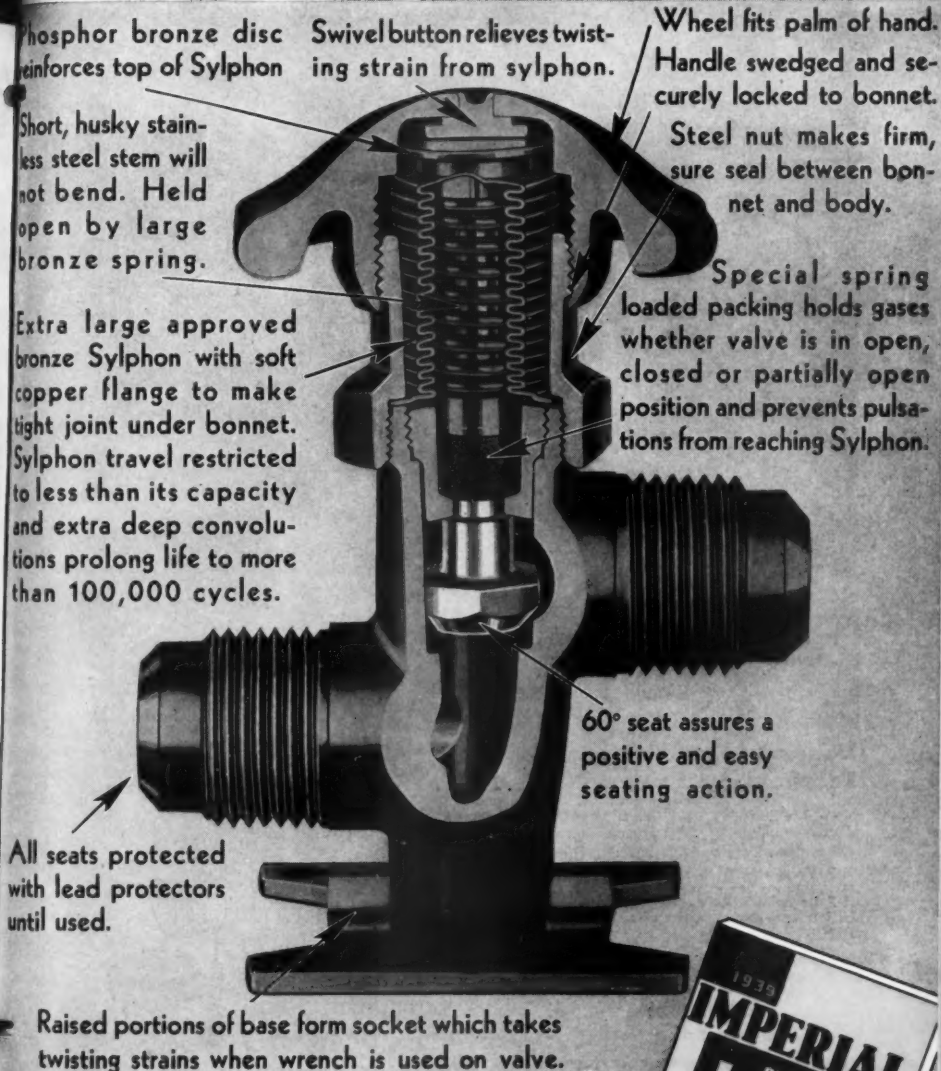
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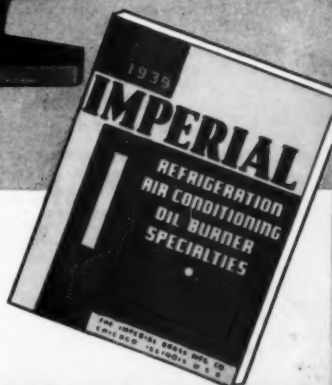
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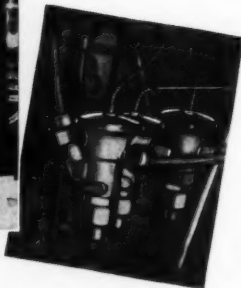
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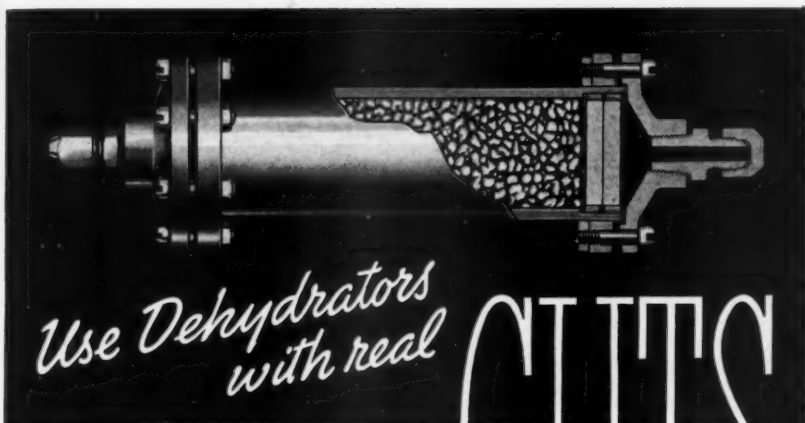
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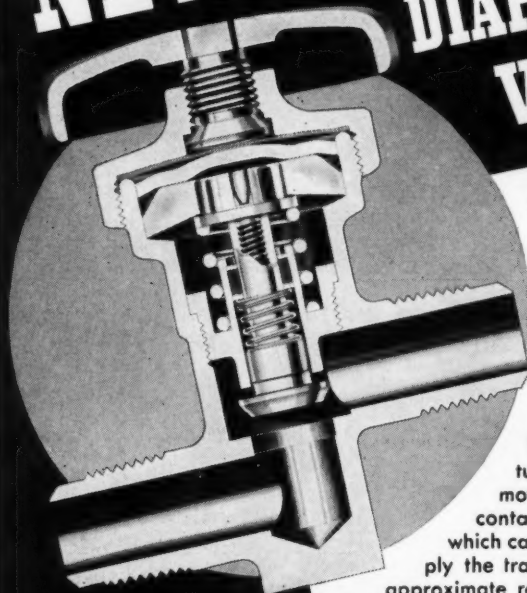
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# The Refrigeration Service Engineer

Vol. 7

No. 1

*January 1939*

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ  
REFRIGERATION SERVICE  
ENGINEERS SOCIETY

## Cover

This month's cover shows several views of work being done on hermetically sealed units in the repair shop of the Flushing Refrigeration Co., Flushing, N. Y.

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# The Refrigeration Service Engineer

Vol. 7, No. 1

CHICAGO, JANUARY, 1939

\$2.00 per Annum

## *Field and Shop Data on* General Electric Refrigerators

*The information contained under this heading is designed to familiarize the individual with the construction and operation of the General Electric hermetically-sealed units and to suggest ways of locating and correcting troubles occurring in the field.*

*Little information is given on shop data because it is believed that there is little to be said about this subject. Shop rebuilding of hermetics is mostly a matter of good shop equipment, extreme cleanliness and care in the work and of replacing all worn parts or restoring them to their original condition.*

*Much of this information has been supplied by Messrs. Schroeder and Jennings of Rex Refrigeration Service Inc., Chicago, Ill. To them we wish to extend our thanks for their generous cooperation.—Editor.*

**E**NTERING the field of electric household refrigerator manufacturing in 1927, with the distinction of being the first to introduce the hermetically-sealed unit, the General Electric Company has become one of the largest and best-known manufacturers in the field. While no authentic figures are available to the writer at the time, with which to verify the statement, it is probable that the number of General Electric refrigerators in use today far exceeds any other

make on the market. Because of this fact, the General Electric refrigerator becomes one of the largest potential fields of endeavor for the refrigeration service engineer, but, due to the fact that the machine is hermetically-sealed, the amount of field service that can be done on them is limited, and the expense of shop equipment necessary for the rebuilding of these units makes it impossible for any shop that does not specialize in this type of work. A convenient exchange policy on defective units, however, overcomes this difficulty, and if the service engineer will do what field service he can, and exchange his defective units with a reputable rebuilding company for properly rebuilt units, he will find this field one of considerable profit.

A review of Table I, showing the units manufactured during the ten years from 1927 to 1937, will reveal several things. Those units manufactured up to and including 1932 are all of the DR or D models, monitor top, hermetically-sealed units, with the exception of two open-type, belt-driven CM models, which were introduced in 1932. Little change was made in the D and DR models during these years, and if you thoroughly understood one of these units, you would be familiar with them all. In the period from and including 1933 to 1934 all

TABLE I—G. E. SPECIFICATIONS

YEARS MFD. FROM TO	COMPRESSOR MODEL	H. P.	SEALED OR OPEN	UNIT LOCATION	LIBS. REFRIGERANT	NO. OF CYL- INDERS BORE AND STROKE
1927—1931	DR2	$\frac{1}{8}$	Sealed	Top	$5\frac{3}{4}$ SO <sub>2</sub>	1—1.0x0.7
1927—1930	DR3	$\frac{1}{6}$	"	"	10 "	1—1.03x1.0
1928—1930	DRA2	$\frac{1}{8}$	"	"	5 "	1—1.0x0.7
1929—1933	DR1	$\frac{1}{10}$	"	"	$3\frac{1}{2}$ "	1—1.0x.55
1929—1931	DRB3	$\frac{1}{6}$	"	"	7 "	1— $\frac{1}{2}$ x1.0
1929—1930	DRA4	$\frac{1}{3}$	"	"	13 "	2—1.03x1.0
1929—1933	DA1	$\frac{1}{10}$	"	"	$3\frac{1}{2}$ "	1—1.0x.55
1930—1930	DRE3	$\frac{1}{6}$	"	"	6 "	1—1.03x1.0
1930—1930	DRE4	$\frac{1}{3}$	"	"	$7\frac{3}{4}$ "	2—1.03x1.0
1931—1933	D30	$\frac{1}{6}$	"	"	5 "	1—1.03x1.0
1931—1933	D35	$\frac{1}{6}$	"	"	5 "	1—1.03x1.0
1931—1933	D40	$\frac{1}{3}$	"	"	8 "	2—1.03x1.0
1931—1933	D2	$\frac{1}{8}$	"	"	$5\frac{3}{4}$ "	1—1.0x0.7
1932—1933	DR35	$\frac{1}{6}$	"	"	$6\frac{1}{4}$ "	1—1.03x1.0
1932—1933	CM1	$\frac{1}{6}$	Open	"	$2\frac{1}{2}$ "	1— $1\frac{1}{2}$ x $\frac{7}{8}$
1932—1934	CM2	$\frac{1}{6}$	"	"	$2\frac{1}{2}$ "	1— $1\frac{1}{2}$ x $\frac{7}{8}$
1933—1934	CB1	$\frac{1}{6}$	"	"	2 "	Rotary
1933—1934	CB2	$\frac{1}{6}$	"	"	$2\frac{1}{4}$ "	"
1933—1934	CB3	$\frac{1}{6}$	"	"	$2\frac{1}{2}$ "	"
1933—1934	CA1	$\frac{1}{8}$	Sealed	"	2.15 Methyl Formate	"
1933—1934	CA2	$\frac{1}{8}$	"	"	$2\frac{3}{4}$ "	"
1934—1935	CD1	$\frac{1}{6}$	Open	Below	2 SO <sub>2</sub>	"
1934—1935	CD2	$\frac{1}{6}$	"	"	$2\frac{1}{2}$ "	"
1934—1935	CD3	$\frac{1}{6}$	"	"	$2\frac{3}{4}$ "	"
1934—1935	CD11	$\frac{1}{6}$	"	"	2 "	"
1934—1936	CK30	$\frac{1}{6}$	Sealed	Top	$3\frac{3}{4}$ "	1— $1\frac{1}{4}$ x.85
1934—1935	CK35	$\frac{1}{6}$	"	"	$7\frac{3}{4}$ "	1— $1\frac{1}{4}$ x.85
1934—1935	CM35	$\frac{1}{4}$	Open	"	$5\frac{1}{2}$ "	2— $1\frac{1}{2}$ x $1\frac{1}{2}$
1935—1937	LK1	$\frac{1}{8}$	Sealed	Below	1.4 "	1— $1\frac{1}{4}$ x.66
1935—1937	LK2	$\frac{1}{8}$	"	"	1.4 "	1— $1\frac{1}{4}$ x.66
1935—1936	DK1	$\frac{1}{8}$	"	"	$1\frac{3}{4}$ "	1— $1\frac{1}{4}$ x.66
1935—1936	CG1	$\frac{1}{8}$	"	Top	$1\frac{3}{4}$ "	1— $1\frac{1}{4}$ x.66
1935—1936	CK1	$\frac{1}{8}$	"	"	$1\frac{3}{4}$ "	1— $1\frac{1}{4}$ x.66
1935—1936	CK2	$\frac{1}{8}$	"	"	$2\frac{1}{4}$ "	1— $1\frac{1}{4}$ x.66
1935—1936	CM32	$\frac{1}{6}$	Open	Below	$1\frac{5}{8}$ "	2— $1\frac{1}{2}$ x $1\frac{1}{2}$
1935—1936	CM34	$\frac{1}{4}$	"	"	$3\frac{1}{4}$ "	2— $1\frac{1}{2}$ x $1\frac{1}{2}$
1935—1937	CF1	$\frac{1}{8}$	Sealed	"	$1\frac{3}{4}$ "	1— $1\frac{1}{4}$ x.66
1935—1937	CF2	$\frac{1}{8}$	"	"	2 "	1— $1\frac{1}{4}$ x.66
1936—1936	CK15	$\frac{1}{8}$	"	"	$1\frac{3}{4}$ "	1— $1\frac{1}{4}$ x.66
1936—1936	CM311	$\frac{1}{6}$	Open	"	2 "	2— $1\frac{1}{2}$ x $1\frac{1}{2}$

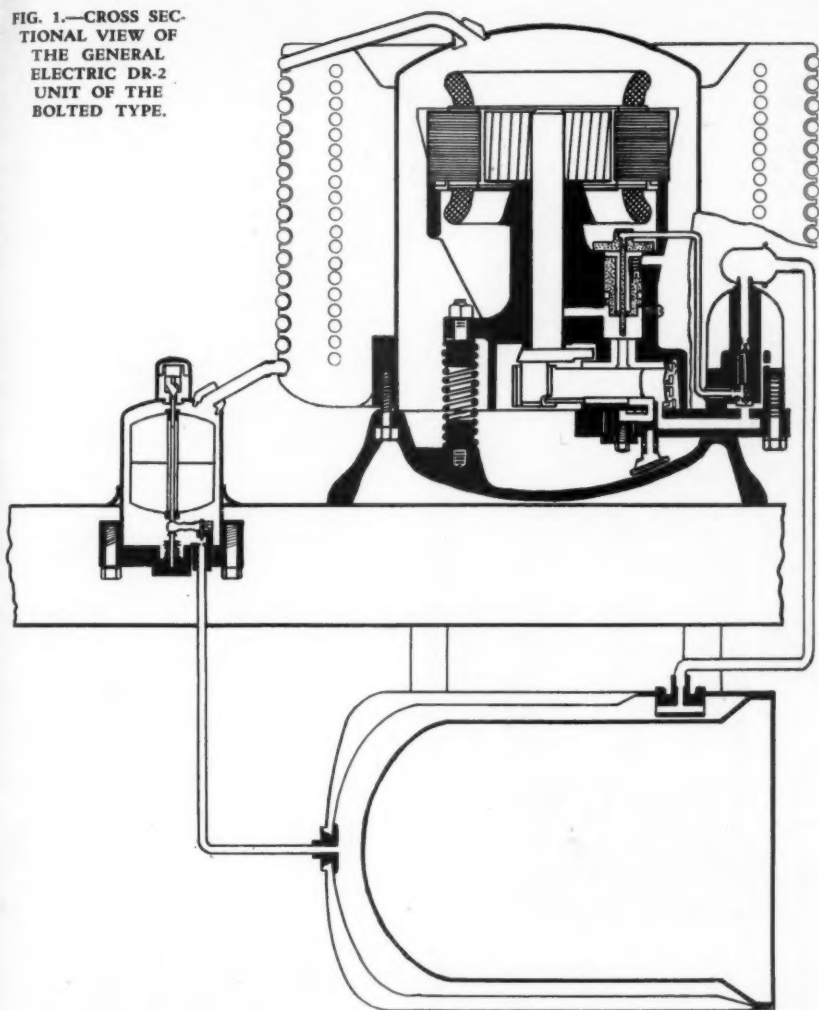
models, with the exception of three, were of the rotary-type compressor. Both open and sealed types were used, and two of the sealed units were charged with methyl formate. Starting in 1934, with the CK hermetic unit, and continuing to the present date, the unit was completely redesigned, returning to the reciprocating-type compressor, charged with SO<sub>2</sub>. Both open and sealed type units were manufactured during this latter period. With the advent of this third group, the dome of the sealed unit was changed from the high pressure side of the unit to the low pressure side. Thus, it may be observed that for the entire ten-year period, the complete line resolves itself into three general groups,

and to understand the design of one of each group is sufficient to understand all.

One feature is common, however, to the entire line. All units are of the flooded-type system, employing a high side float as the refrigerant control, and a thermostat as the motor control. In the information to follow, only the hermetically-sealed models of the first group will be considered. Those of the last two groups are not yet out of guarantee, and will, therefore, not be subject to service by the independent service organization. The open-type units are essentially the same as any other conventional-type unit.

Fig. 1 is a plan of general construction found in the DR units, in which you will

FIG. 1.—CROSS SECTIONAL VIEW OF THE GENERAL ELECTRIC DR-2 UNIT OF THE BOLTED TYPE.



note the relative position of the various parts. In future articles on this subject will appear views of the CA hermetic units, which employed a rotary-type compressor and which were charged with methyl formate. Also the CK type unit, which employs a reciprocating-type compressor, charged with  $\text{SO}_2$ , will be shown.

The General Electric unit consists of four principal parts; namely, the dome or compressor unit, the float valve, the electrical

control box, and the evaporator. These parts, with the exception of the control box, are all sealed by electric welding. The only opening to them is the charging valve, located on top of the float housing.

#### Float Valve

The float valve is so arranged that turning the charging valve needle out approximately one turn places the valve in a purge position, so that air or incondensable gases may be

purged off. Opening the valve stem four turns or more lifts the float valve needle off its seat so that when charging, the gas is permitted to enter directly into the evaporator instead of being forced back into the condenser and compressor dome. Fig. 1 and Fig. 2 will show how this is accomplished.

The float ball is constructed of steel, which permits the use of a magnetic float lifter in case of a stuck float.

### The Compressor

The compressor on all the domestic size units is of the single-cylinder, reciprocating

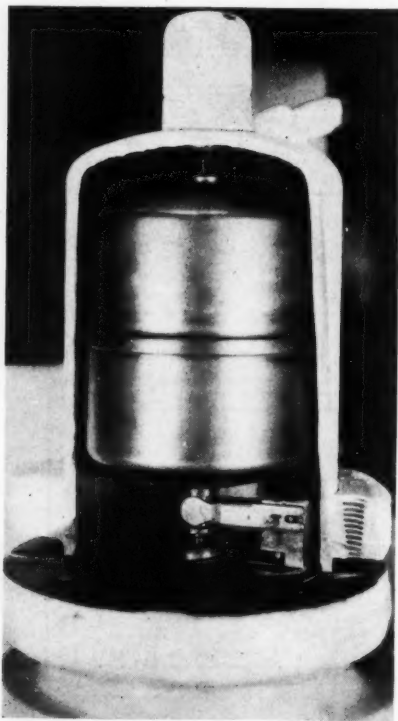


Fig. 2.—Cutaway view of float valve used on DR-2 unit.

type. Some larger commercial models employ a two-cylinder compressor. The compressor departs from the usual type of construction in that no eccentric rod or connecting rod is used. The piston is connected directly to the crankshaft, and the cylinder block oscillates with the motion of the piston. As the gas is compressed, it is discharged directly into the compressor dome, and

travels from there to the condenser.

Two views of the DR compressor unit, in the process of dismantling, are shown in Fig. 3. On the left is the unit as it will appear when the dome has been removed, exposing the working parts. While the one shown is of the bolted type, the same mechanism will be found in the welded type. The unit floats on three springs, which absorb most of the vibration. So that as little vibration as possible will be carried through the suction line, which is the only other metal-to-metal contact between the unit and outer casing, the tubing is given two turns around the unit, forming a flexible connection. Where the suction line enters the base of the dome, it is brazed into a screw connector, with a nut on the under side of the base. Thus, when the tubing is cut outside of the unit and the nut removed from the connector, the suction line may be pulled through the base.

The three motor leads are provided with metal clips, which are soldered to metal glass leads passing through the dome base. These should be unsoldered with a soldering iron. When the three nuts above the spring mountings are removed, the compressing unit may be lifted out of the dome base, and when turned upside down will appear as in the right-hand side of Fig. 3.

In this position, the compressor and valve plate are exposed to view. The next step in the dismantling process is the removal of the valve plate. To do this, remove the six cap screws and the two dowel pins, which hold it to the unit frame, and pry off with a screw driver. The cylinder block and piston will then lift out in one unit.

Fig. 4 shows these three parts as they will appear when removed, which permits an explanation of the operation of the compressor. As mentioned before, the cylinder oscillates with the motion of the piston. This oscillating action is utilized to operate sliding valve ports between the valve plate and cylinder block. The suction gas enters at the opening (F) in the valve plate and travels through a connecting opening to the valve port (A). Movement of the cylinder block opens and closes this port at the desired time. A close-fitting polished surface between the two prevents any undue leakage of the valve. The discharge valve is of the disc flapper type, and is contained in the cage on the cylinder block shown at (C).

The entire mechanism is assured of an adequate supply of oil through a forced feed circulating system, which is fed by a small

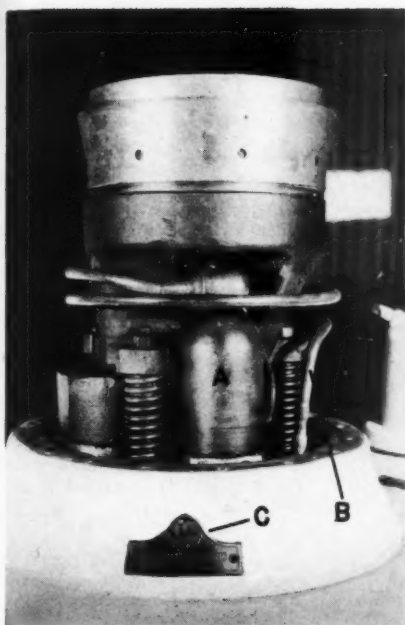


FIG 3.—TWO VIEWS OF THE DR-2 UNIT WITH THE DOME REMOVED.

- A—Check Valve  
B—Suction line from evaporator  
C—Remove this name plate in order to reach the oil conditioning heating element.

- D—Oil strainer  
E—Dowl pins  
F—Screw connector for suction line where it passes through the dome base

oil pump. The piston of this pump is fastened to the main piston, as shown at (D). The movement of the cylinder block also controls the suction and discharge ports of this pump. These ports are shown at (B). All the oil is drawn through a fine mesh screen, which may be seen at (D) in Fig. 3. The pressure created by the oil pump also operates the unloader valve, but before going

into that let's continue with the dismantling process.

Four screws, which pass through the stator winding, hold it to the unit frame. Remove these screws and, using a block of wood and a hammer, strike the side of the stator to loosen it from the frame. The rotor can be pressed off the crankshaft if it becomes necessary, and the crankshaft removed.

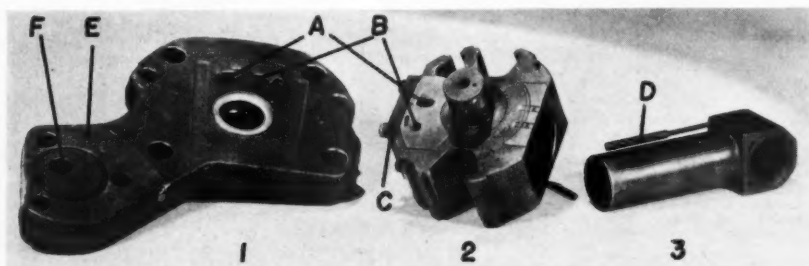


FIG. 4.—THE THREE PRINCIPAL PARTS OF THE COMPRESSOR.

- 1.—Compressor Valve Plate. 2.—The Cylinder Block. 3.—The Piston. A.—Suction Port. B.—Oil pump suction and discharge ports. C.—Compressor discharge valve and cage. D.—Piston for oil pump. E.—Recessed ring in which the check valve body fits. F.—Suction line entrance to plate which is connected to port A.

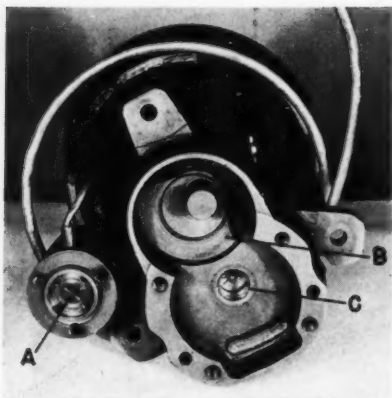


Fig. 5.—Bottom view of compressor frame after parts shown in Fig. 4 are removed.

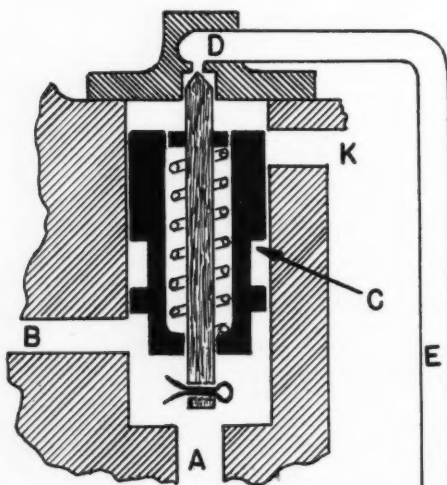
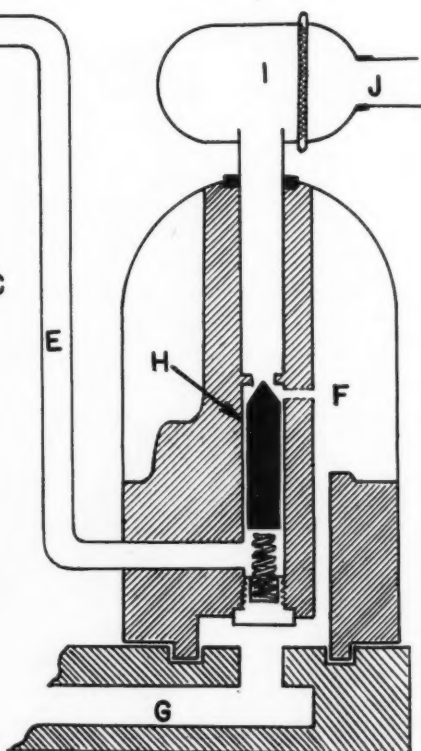


Fig. 6.—Check valve and pressure balancing device. A.—Oil entrance. B.—Oil exit passage. C.—Plunger and valve needle assembly. D.—Valve seat. E.—Copper tube. F.—Opening to low side of system. G.—Suction passage in compressor valve plate. H.—Check valve needle. I.—Screen. J.—Suction line from evaporator. K.—High pressure gas port from dome of unit.

The only thing left hanging to the frame at this time is the lowside check valve and the unloader valve. Two screws hold the cap of the unloader valve in place. Upon removal of these, the lowside check valve and the unloader valve cap, together with the suction line, is removable in one piece. The unloader check valve plunger and needle valve can be lifted out of the frame through the cap end of the opening.

The unloader device pictured in Fig. 6 is for the purpose of balancing the pressure on both sides of the compressor piston when the unit stops, so that less torque is required in starting the unit. Due to this feature, no capacitor is required in the starting circuit to start the motor.

When the machine starts in operation, the oil pump forces oil through the opening (A) and out the opening (B) to other parts of the unit. Due to the oil pressure, plunger (C) is forced upward, closing the opening at (D). Opening (G) is connected to the



suction side of the compressor and gas is drawn through here from port (F) and tube (E), reducing the high pressure at these points so that the check valve needle (H) drops of its own weight. Gas is then drawn through the screen (I) and the suction line (J), which goes to the evaporator.

When the compressor stops, the plunger (C) in the unloader drops by its own weight as soon as the oil pressure is reduced. This opens the valve port (D), permitting high

pressure gas from the dome to enter the tube (E) from the opening at (K). The high pressure gas then forces the valve needle (H) upward, closing the check valve and preventing high pressure gas from entering the evaporator. High pressure gas passes around the sides of the needle (H) through port (F) to the suction side of the compressor. Through this means, the pressure on both sides of the compressor is equalized.

(To be continued)

## Accident Prevention and First Aid in Refrigeration Service

By V. C. KELSEY \*

**T**HERE are several factors that affect the safety and efficiency of your respective operations, but all of these are reflections of management. I say this because management determines the policies of the business and selects the men to carry out those policies.

Safety and efficiency are buddies—they go together. Efficiency is the elimination of waste and safety eliminates waste. They eliminate waste of human energy, waste of materials, and waste of time.

An accident is a mistake,—or conversely; a mistake is an accident or the cause of an accident. Mistakes are costly. They cut into your profits and contribute to loss of good will among your clients. It is peculiar that many employers do not fully realize that frequencies of certain types of accidents indicate the type of management in control. Indeed, quite often a single accident indicates a fundamental weakness in management. For instance: Suppose a certain shop produces a number of accidents described thusly, "While tightening a nut the wrench slipped and bumped my hand," or "The screw driver slipped while I was tightening a screw," or "Chip flew off chisel while I was cutting a bolt in two and the piece hit my right eye." What causes accidents of this type? It is very simple! It would appear

that neither the user of these tools nor the management pays any attention to the condition of hand tools. Wrenches with spread jaws are likely to slip and cause some very bad injuries; screw-drivers with bits that are not square slip more easily than those with square and sharp bits; chisels, punches and drift pins that have been peened out to produce mushroom heads chip off and the piece flies with great force causing puncture wounds and some times putting out an eye. Now good tools kept in good condition do not cause as many accidents as tools in poor condition; furthermore, using good tools and the proper tools increases the efficiency of the workman.

Getting back to the relation between mistakes and accidents, I wish to enumerate a few general causes of mistakes or accidents:

1. Errors in judgment, or miscalculations.
2. Failure to give clear orders.
3. Failure or inability to understand orders as given.
4. Inexperience or lack of knowledge.
5. Carelessness, lack of orderliness, sloppiness and the like.
6. Inattention, mind wandering or lack of concentration.
7. Poor health.

Some mistakes or accidents can be corrected but others cannot. For instance, we cannot replace a finger, an arm, leg or an eye. Nor can we recover the refrigerant that leaks out of a container on which the valve

\* Accident Prevention Dept., Commercial Standard Insurance Co. Paper delivered before December 13 Meeting, Chicago Chapter R.S.E.S.

has been damaged by rough or careless handling causing the valve to leak.

There is only one way in which we can profit from accidents: When we study the cause of a certain accident and learn proper steps necessary to prevent similar future occurrences and then put those preventive measures into practice, we profit from the accident. In like manner, near accidents or accidents that almost happened, are warnings, that when heeded, help to prevent accidents.

I want to make one very definite impression: Those organizations that have the greatest number of accidents are those where the greatest number of costly mistakes occur. High accident frequency indicates inefficiency. Why does that organization with relatively high rate of accidents appear to be having such a struggle? Why doesn't it make any money? Why is its business poor? Just this: Those same practices and policies that cause accidents also cause costly mistakes, lost motion,—inefficiency!

#### For Example

Sometime ago, I was working with a printing company. The accident frequency was high. Numerous accidents occurred there because the shop superintendent did not properly plan his work and work his plan; plant housekeeping was bad. Everyone was in a hurry but accomplished little. Having so many accidents, they were bound to have other mistakes. Then, strange as it may seem, the president of the firm heard me discussing the problem and immediately recalled a very costly error—they had just printed 500,000 multi-color advertising circulars on two sides and then discovered an error that required the reprinting of the entire lot. The cost of that one accident or mistake was more than the cost of their personal injury accidents for an entire year.

Another case: A shop where they manufactured metal cabinets was found to produce many and serious accidents. When I inspected it, I found a dirty floor. It was concrete, but being so dirty I thought it was a dirt floor. Sheet metal was found in small stacks all around the shop. There was no semblance of order. I talked to the management from the president on down but no one seemed to know what I was talking about. I decided that it was a poor risk and that they probably couldn't pay for their insurance anyway. The risk was declined; that is, we refused to issue a policy to this firm. A few months later they went bank-

rupt. The plant was purchased by a good business man. He hired a good shop superintendent. The new superintendent cleaned up the shop, threw away useless material, rearranged the shop, stored raw materials neatly and conveniently, repaired the equipment and provided effective guards. He kept the same employees that were previously employed by the former management. When the risk was inspected for the new management it was approved for insurance and scarcely any accidents were reported. Now the former management produced forty cabinets a day with nineteen men and the latter management produced 250 cabinets per day with the same crew. This may sound like a fairy tale, but it is a fact and it is my own personal experience.

#### Safety Pays

I know of another case where a metal specialties company shut down for two weeks because they could not get insurance and they were unable to pay the losses themselves. Finally a company agreed to write their insurance at twice manual rates provided every recommendation of their engineer was carried out to the letter. This was done. The engineer rearranged this plant, made some special rules and then watched them. The plant did not have a single compensation case and only twelve doctor bills during the year and they increased their production 20 percent with the same crew!

I sincerely hope the foregoing examples clearly indicate what I mean when I say, "Safety and efficiency are buddies."

Generally speaking, in order to have a clean accident record and an efficient operation we need healthy workmen with clear heads; men who can concentrate and who have their minds on their business all the time. It is also necessary that the men be neat and orderly and have the ability to organize their work.

Suppose a man does not organize his work properly and have a definite plan for the job. He starts working on a refrigeration unit with perhaps a screw driver and a pair of pliers, and then he gets to the point where he needs a special wrench. It is at the bottom of his kit so he drops the tools he is using and starts hunting for the one needed, fumbling around in the kit until he gets it. When he is through with it, he needs the screw driver again, doesn't remember exactly where he put it, finally gets up and finds it was just behind him, sits down and goes to

work again. Now he needs that wrench again, and while hunting for the screw driver mislaid the wrench—more lost time. Every time he needs a tool he has to hunt for it—something like the proverbial plumber. It takes him an hour to do a 30-minute job for an ordinary service mechanic.

The efficient man does it much differently. He gets the history of the refrigerator as best he can from its user. Then he has a good idea as to what is needed. Now he quickly runs over the operations necessary to do the job laying out his tools in the order that he will need them. He makes provision for emergencies too. Has his gas mask handy and is prepared to stop an unexpected leak in a pressure line if it occurs. He does not hurry but performs every operation with care and precision. He has a done a fine job in 20 minutes.

Now the first man is worn out at the end of the day, but the second is not nearly so tired and he has done more work better.

Every industry has its special problems. I shall discuss some of your problems with you and in some cases offer helpful suggestions and in others perhaps start a trend of thought whereby you will solve others for yourselves. I emphasize that I am not a specialist in refrigeration or air conditioning, but draw on my mechanical experience and training and ten years' experience and study of accident prevention.

### Problems Confronting You

The refrigeration service engineer is confronted with several specific types of problems. Briefly, these are:—

1. Mechanical: In the shop and out on the job.
2. Chemical: Which may be divided into refrigerants and cleaning agents.
3. Automobile accidents.
4. Dog Bites.
5. Contagious diseases.

With regard to mechanical accidents in the shop, all machine tools should have as many of the moving parts completely enclosed as is practical. We have already discussed the value of using good hand tools.

With respect to accidents on the job, one of the principal mechanical hazards is the use of hand tools which has been previously discussed, but it is also well to keep in mind that while making adjustments on refrigerator machines, the machine should be at rest wherever possible; otherwise extreme care should be taken to avoid getting the fingers caught in a moving part and seriously in-

jured or possibly amputated. Proper and adequate light is of great importance and it is only inviting trouble when you attempt to work in the dark.

Under the chemical section, refrigerants may be classified as flammable and explosive or toxic. We shall discuss some of the common refrigerants in detail.

### Dangers of Ammonia

Ammonia is a gas commonly used on the larger systems. It is toxic in high concentrations; 1 percent or one volume in one-hundred is very likely to be fatal. Two volumes per thousand may cause serious irritation of the respiratory organs and the mucous membranes of the eye and may cause blindness. 16 percent to 25 percent ammonia by volume in air is explosive. However, ammonia issues its own warning, and 53 parts per million will create a detectable odor and 0.3 to 0.5 of one volume per thousand volumes gives the strongest concentration of ammonia fumes bearable for a period of thirty minutes. Therefore, the warning issued long before the concentration reaches any danger point indicates that it is a safe refrigerant.

Foul gases are likely to be generated in ammonia systems under certain conditions. If there is a leak in the system and air gets into it nitrogen may be formed. Hydrogen is sometimes produced by the corrosive action of ammonia. These gases may be dangerous, but there are safe methods of extricating them from the system.

Butane is little used as a refrigerant. A 5 percent concentration by volume in air is not dangerous to life. However, it may cause something similar to naphtha jag and is very much like gasoline in its characteristics. 1.6 percent to 6.5 percent in air is explosive with an apparent ignition point of 430 degrees centigrade. It has a very slight odor. One pint of butane evaporated in 200 cubic feet of air will render the contents explosive.

Carbon dioxide is a high pressure refrigerant. It is odorless and slightly toxic. Its tendency is to suffocate by excluding oxygen. A 10 percent concentration may produce unconsciousness. The symptoms produced by carbon dioxide are headache, sweating, dimness of vision, tremor, and in heavy concentrations, increased respiration which acts as a warning. Carbon dioxide is non-inflammable, non-corrosive and is an excellent fire extinguisher.

Sulphur dioxide produces a very irritating odor and even from eight to twelve parts

per million by volume causes slight throat irritation. Such concentrations are not harmful. 500 parts per million by volume produce a sense of suffocation, even with the first breath, and higher concentrations produce a tendency to nausea. Sulphur dioxide is not likely to do any harm to health unless it is impossible for the victim to get away. I have not heard of a case or been able to learn of any case where sulphur dioxide has produced any chronic ailments or permanent internal harm except where the victim was confined for one reason or another. Sulphur dioxide is non-inflammable and non-explosive.

Methyl chloride is an odorless refrigerant and its physiological reaction is anesthetic. Its toxic action is delayed, and a 2 percent concentration in air by volume is considered dangerous to life if exposure is for two hours or more. There is another feature which should be considered and remembered by the refrigeration service engineer. Methyl chloride on contact with flame or hot surfaces gives off dangerously toxic fumes known as phosgene. Methyl chloride is moderately flammable and is explosive in concentrations of 8.1 percent to 17.2 percent mixed with air. Its apparent ignition temperature is 682 degrees centigrade. Refrigerants of this type should have some warning agent added to produce a strong and uncomfortable odor whenever there may be a leak.

### Freon

Dichlorodifluoromethane, commonly called Freon or "F-12" is practically non-toxic in itself. However, in contact with flame or hot surfaces, it decomposes, giving off toxic fumes which tend to damage the nervous system. However, the fumes give adequate warning. The only way Freon in itself can do harm is to present such extremely high concentrations as to exclude sufficient oxygen. Freon is non-combustible and non-explosive.

Dichlorotetrafluoroethane, commonly called "F-114" is practically the same as Freon.

Ethyl chloride has a very pungent odor and is anesthetic in its effect on the system. A 6 percent concentration by volume in air may be dangerous to life in thirty minutes. It is possible to tolerate the odor of ethyl chloride for a sufficient period to render the exposed person helpless. It would seem, therefore, advisable to have a warning agent mixed with ethyl chloride. It is flammable, with an apparent ignition temperature of

519 degrees centigrade with an explosive range of 3.7 percent to 12 percent by volume.

Methylene chloride or Carrene is an odorless refrigerant which may possibly give warning of its presence by its physiological effect. 5 percent by volume is dangerous to life when the exposure is for thirty minutes or more. Contact of Carrene with flame or hot surfaces causes decomposition, giving off toxic fumes. These fumes, however, are very irritating and give adequate warning. Methylene chloride is practically non-inflammable at ordinary temperatures and the ignition point is apparently 662 degrees centigrade.

It will be noted from the foregoing that the chlorides are all likely to give off toxic fumes in contact with hot surfaces or flame. This includes of course "F-12" and "F-114."

### Classification

From the fire and explosion hazard point of view and also taking into consideration the working pressures, I would list the refrigerants in order from the safest to the most hazardous as follows:—sulphur dioxide; carbon dioxide; Freon or "F-12"; "F-114"; Methylene chloride or Carrene; ammonia; methyl chloride; ethyl chloride; butane.

From a toxic standpoint, I would list the refrigerants beginning with the safest and ending with the most hazardous as follows:—"F-12" and "F-114"; butane and carbon dioxide; ethyl chloride and Methylene chloride; methyl chloride; ammonia; sulphur dioxide.

Some of these refrigerants may produce a chemical burn, particularly to the eyes. All of them will cause freezing when the liquid gas comes in contact with the skin.

First aid for eye injuries is very important. The eyes should be copiously flushed with cold water. (Of course the water should be clean.) Then medical attention should be obtained as soon as possible. By no means use a neutralizer until the irritating refrigerant is completely washed out of the eye for if you do the reaction may cause intense heat and actually produce a severe burn. After the eye is thoroughly washed, a 2 percent boric acid solution may be used to counteract the refrigerants that are acid in character.

If a person is overcome by gas, he should be removed to fresh air and artificial respiration administered and medical attention be immediately obtained.

*(To be continued in the February issue)*

# *Servicing* Hermetically-Sealed Units

By S. R. THOMPSON \*

THE servicing of hermetic units requires more specialized experience, knowledge and equipment than any branch of the refrigeration servicing field, yet it has the least amount of published information devoted exclusively to it. The reason for this is that, although the work is of a highly specialized nature, there is little that can be said about it which differs from the information given on refrigeration of any other type, except that greater care must be taken.

The main difference between servicing hermetically-sealed units and open type units is the additional practical experience required, the special equipment needed, and the extreme cleanliness, care and preciseness that should be used in the work.

The knowledge and equipment may be secured through various outside sources, but the practical experience must be gained through your own efforts and time, and no amount of written information is going to give it to you.

## Knowledge and Equipment

Obtain as much information as possible about each make of unit in regard to its refrigerant cycle, electrical circuits, type of condenser, chronic troubles (if any), replacement of parts recommendations (some parts, a few years after manufacture, will be replaced with a much better article).

Subscribe to a good refrigeration magazine. Trade periodicals, over a period of time, will always cover and explain different service troubles and methods of handling, besides giving information in such a way as to keep building up the reader's knowledge of refrigeration.

Manufacturers' manuals of equipment are very valuable. They should be kept available for use, as they give many facts that will explain in a clear manner some problem that much experience would require to solve.

After all, they built the mechanism, and any information they take the trouble to publish is the correct information.

We recommend for the tool kit, a Neon test lamp and a Frigidaire special hermetic test cord. This cord can be used at the binding posts of the unit, located at the compressor dome, in a definite attempt to find out if the unit itself is defective. It also can be used to test different electric items on the unit when its use is understood. On units that use relays to charge the starting windings on starting the motor, this cord is particularly handy (disconnect leads before using cord). These cords can be made locally.

General Electric Co. makes an electromagnet type float lifter that is a good tool to have. Its use is not intended to correct parts that are defective or dirty, although sometimes it gives temporary results. It will, however, clear a good float valve of oil, and after adding refrigerant (that being the cause of trouble) the job will operate normally. This tool is a service device and not a mechanic to repair floats from the outside.

Special hermetic tools are made by several well-known tool makers, which are well made and, if used properly, will last a long time. Obtain these from your jobber. There are not many, but each one will simplify an operation. Charging valves are very necessary, and are now being made with adaptors to fit several different makes and models.

## A Few Requirements for Good Operation

Keep the entire unit clean and clear of dust, dirt and grease, especially around the condenser, whether it be a forced-air or still-air type. The condenser, if finned, should be cleaned with a bristle wire brush to dislodge all particles of dirt between the fins. One of the most serious troubles with hermetics is to keep the head pressure down to normal pressure, and allow the motor and other parts to carry a normal load.

\* Refrigeration Maintenance Corp., Chicago. Paper delivered before annual R.S.E.S. Convention at Buffalo, N. Y.

Place the cabinet in such a position as to provide ample clearance for air circulation. This is important to all makes using still-air condensers, and these types should not be placed under a shelf, as the air must be allowed to rise vertically up and over the entire cabinet.

Hermetic refrigerator cabinets themselves should be kept tight. This includes door gaskets, rubber grommets of the evaporator frame, etc. Hermetic refrigerators are lower in horsepower than the conventional unit, and any heat leakage other than normal loss will result in longer running cycles, excessive evaporator frost build-up, and high light bills.

Place the cabinet on a solid part of the floor whenever possible, and place shims under legs, if the floor is uneven. The unit should be level for several reasons: one, that many types suspend the dome in a definite space and if not level, the dome will perhaps touch the solid part of the frame or cabinet, and be noisy; two, refrigerant levels should be even, especially in the evaporator.

In outlying districts, be on the watch for low or high voltage, which will result in electrical trouble, especially around the relay circuit. The use of transformers is recommended for this purpose to build up or reduce the voltage, to conform to the nameplate on the unit.

Some hermetics, employing forced-air over the condenser, have a set of ducts to guide air to the fan and over the condenser. These sometimes get plugged up or disturbed in such a way that their purpose is lost. Any such trouble at this point will cause overloads on the motor, due to the heat being unable to leave the condenser.

All connections on gas lines of hermetics must be tight because of the small amount of gas used, and on vacuum units, air presence is very undesirable because it raises the wattage of the motor, and moisture will also complicate troubles in sticking of vital valves ( $\text{SO}_2$ ), and in methyl and Freon units, will clog refrigerant at expansion point.

#### Refrigerant Expansion Point

Major ones used are the high side float valve, capillary tube, restrictor (which operates on same principle as the capillary tube) and expansion valve, as used on the conventional unit. An overcharge of oil in the unit will cause trouble in any of the above types, due to the fact that liquid oil alone, without refrigerant to carry it along,

has a difficult time in passing through. Unless the unit was overcharged with oil at the factory, which is rare, adding of gas will eliminate oil binding. Moisture also may plug these, and dehydrators, using a good dryer which won't break down, are recommended. An  $\text{SO}_2$  system with moisture will show trouble here at an early stage, and an overhaul and dehydration constitute the best method of correcting the trouble.

Heating of capillary tubes and restrictors will sometimes expand them enough to permit themselves to clear. Heat them just short of melting the solder joints.

#### Mechanical Designs

Compressors in hermetics consist mostly of rotary, reciprocating types, although double-gear types also have been used.

Motors are usually of the split-phase type. To start them, several means are employed. Condensers are used to give a large surge of electrical energy, and then again, a starting winding is energized along with the running winding momentarily, by the means of a relay, which goes into action when an overload is encountered on the running winding. Unloading valves operated by solenoid windings or pressure are also used to take complete load off the motor until it gets up to normal speed. Rotary pumps, employing vanes, act as their own unloading devices, due to the fact that they don't close against the cylinder wall until the motor is at top speed.

Condensers are mostly air-cooled, and of two types: small in size and finned, through which air is forced by means of a small external motor and fan; large in size, and depending upon a natural circulation of air over or through them. This air is set in motion by the heat that is in the plate or fin.

Evaporators usually are of the flooded-type, and are fed by devices described under "Refrigerant Expansion Point."

#### Electrical Equipment

Do not eliminate or interfere with the action of any protective device placed on the unit by the manufacturer, whether it be electrical or of the pressure-type. Doing so may cause damage in some form, which will increase the cost of repairing the unit should it be necessary to repair internally. The motor windings are very delicate and are the first to be damaged when protective devices fail.

Oil the fan motor. It requires more oil than the average serviceman thinks, and some require special effort to get the lubrication at the correct point.

Electrical contact points are small, and if ever dressed down by filing or sanding, be sure they are free of loose filings. It is advisable to replace any poor contacts because filing is usually a temporary repair.

Be sure all electrical connections are tight and in good condition, as some units have a high amperage on start and closely rated heating overload protector. Any stuttering of the electric current, due to a bad contact making the motor start several times in succession, will trip the heater element protector.

### Controls

Thermostats are used and are usually of the "cold control" type.

The usual hermetic, in good condition, can be kept at a cold cut-out switch setting, and the cut-in comparatively warm (factory setting)—the idea being to give the control a wide spread in its differential. On the other hand, a unit in poor condition can be nursed along by keeping the cut-out point warmer than usual, and the differential close in its spread—the idea being to give more or less of a short-cycle, and still give good refrigeration.

Some controls are placed on or near the evaporator, which may cause corrosion of the mechanism, sluggish action, electrically-charged cabinets, or a closed circuit at this point.

Average setting are 8 degrees to 13 degrees on cut-out and 25 degrees to 30 degrees cut-in. Freeze the thermometer to the tray sleeve with water in such a way that readings can be made without moving the thermometer. This gives accurate readings, and results.

Be sure the control bulb is fastened tightly to the evaporator and that the small tube leading from the bulb to the control is pitched upwards immediately after leaving the bulb. This keeps the liquid in the bulb and not in the tube.

### Condensers and Relays

Condensers and relays are used to start the unit, overcoming the load of starting.

We recommend using the manufacturer's article on replacements, although exact sized parts can be purchased, which are made by electrical equipment manufacturers.

Some hermetic manufacturers have improved greatly on relays and have exact replacements to put on units, made in the years previous.

Weak condensers are usually reflected in the relay refusing to release. They can be tested easily by putting the terminals against the two line terminals, and then removing the line, and if the condenser is any good, a spark will jump when the two condenser leads are brought together.

### Service Operations in the Field

On any occasions when the system is opened for service, be sure all materials, charging lines, etc., are clean and in good condition. Any addition or removal of refrigerant or oil should be done slowly and with care in regard to quantity. Add refrigerant through the low side if possible, and take care that air is not allowed to enter the system because it may trap itself some way internally so that removal is almost impossible. On units that have no liquid receiver, most of the refrigerant charge is stored in the evaporator itself, and when charging, be sure the amount in there is correct. Many manufacturers have the thermostat bulb mounted high on the evaporator, and if the refrigerant level doesn't reach the bulb, poor refrigeration will result.

Do not overcharge the unit, as this will result in refrigerant spilling over into the suction line and frost back; also, it cuts compressor capacity.

Use packless shut-off valves when cutting into a line, and after use, leave them on the system, open end capped (providing no charging valve openings are on the unit).

Do not use excessive flux in sweating joints, because it may lodge in the restrictor or some vital valve seat.

On noisy units, the adding of gas and then applying heat to the evaporator will sometimes return enough oil to the compressor to make it run quieter.

On units where the dome is suspended by means of springs or rubber, make sure it is suspended evenly so it won't touch parts of the frame. New and live rubber parts sometimes help.

Many of the units are shipped with the dome fastened down, and care should be taken so that bolts are removed or properly adjusted.

# Making a Handy Expansion Valve Adjusting Tool

By L. K. WRIGHT

EXPANSION valves are placed in fairly inaccessible places, first, because space is valuable in a household box and the valve must be set into a rather restricted location—secondly, the manufacturer feels that hiding the valve will remove it from the sight of the owners and therefore not tempt him to try adjusting it. The expansion valves in many cases are adjusted by means of a small screwdriver. Oftentimes the space is so scant as to render difficult the manipulation of even the smallest screw driver commercially obtainable.

The service man who has time and inclination can turn out his own valve adjusting tool, as outlined in the following text.

To make one of these handy tools secure an old automobile valve stem. In many of

extremely tough and a fine pin-punch can be made. The steel being flexible and tough will stand up better than many of the commercial punches on the market.

The dimensions given in Fig. 1 were worked out as a result of a study of the different expansion valve slots. The stem end is usually about  $5/16$  inch in diameter and is best merely formed into a screw driver end. Do not thin the edge to a fine line. Slots in valves are usually fairly broad.

In forming a screw driver end do not get too much taper or wedge-like effect. This will result in the tool jumping out of the slot when a stubborn or stuck screw plug is met with. Have the end more or less flat in form as it holds better than the taper.

Where the steel in the valve is fairly soft,



FIG. 1

the modern cars this valve is made of a special hard steel and the worker will have to resort to grinding the tool to shape. This is how the writer fashioned the first one he made. This tool has seen a lot of service and is good for many more years.

Cut off the stem end of the valve as shown in Fig. 1, by grinding or through use of the hack saw if the steel is soft enough to cut. Save the straight end for an excellent pin or prick punch can be made of it. By grinding the end to a point a serviceable prick punch can be obtained—one that will stand a lot of abuse. Having a good broad head it is easy to use.

To make a pin-punch the end is ground to the proper diameter and this dimension carried along a distance of an inch and a half or more. The steel in automobile valves is

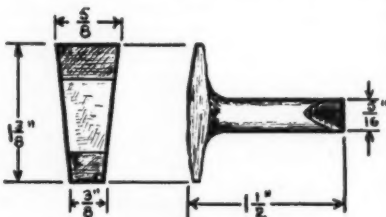


FIG. 2

cut off a slice from each side and then square off the ends of the remaining ends. Grind or file to screw driver ends, as per the dimensions given in Fig. 2. Of course, where very tough alloyed valves are encountered they will have to be ground to shape on an emery wheel. The extra effort is worth it, for such a tool will last a lifetime.

While the dimensions given may be adhered to, the worker can produce a smaller sized tool for work in very close quarters. It is not advisable to increase the size, however, for the idea in making the tool was to get one of small compact size, suitable for work in cramped quarters and to have a variety of screw driver tang ends for different slots.

For work other than expansion valve adjustments, an excellent off-set screw driver

can be made by grinding the head as shown in Fig. 2 and leaving the stem end intact to act as a handle. This is a good tool for getting into inaccessible places. It is used

for holding back on the screw so a wrench can be applied to the nut, either to tighten the assembly or to effect removal of the parts.

## MAKING PIPE BUSHINGS OUT OF STANDARD PIPE

DO you know that first class pipe bushings can be made out of standard pipe? Many users of pipe don't know that it can be done. Or, if they know that it can be done they don't know the correct size of drill to use for tapping. I have occasionally made bushings out of pipe, but each time I found it necessary to first look into my handbook for the drill size to use and that is so much trouble that it is frequently easier to go to the store and buy a new bushing. Recently, though, I collected all of the data together for all bushings that can be made out of ordinary sizes of extra heavy and double extra heavy piping, compiled the figures in tabular form, and here they are.

TABLE I. TABLE SHOWING SIZE OF PIPE TO USE FOR BUSHINGS

To bush from	Use this size pipe	Use drill or reamer size
$\frac{1}{4}$ to $\frac{1}{4}$ in.	$\frac{1}{4}$ in. e. h.	$\frac{21}{64} = 0.328$ in.
$\frac{3}{8}$ to $\frac{1}{4}$ in.	$\frac{3}{8}$ in. e. h.	None
$\frac{1}{2}$ to $\frac{1}{4}$ in.	$\frac{1}{2}$ in. d. e. h.	$\frac{21}{64} = 0.328$ in.
$\frac{3}{4}$ to $\frac{1}{4}$ in.	$\frac{3}{4}$ in. d. e. h.	$\frac{27}{64} = 0.422$ in.
$\frac{1}{2}$ to $\frac{3}{8}$ in.	$\frac{1}{2}$ in. d. e. h.	$\frac{9}{16} = 0.562$ in.
$\frac{3}{4}$ to $\frac{3}{8}$ in.	$\frac{3}{4}$ in. e. h.	$\frac{9}{16} = 0.562$ in.
$\frac{1}{2}$ to $\frac{1}{2}$ in.	$\frac{1}{2}$ in. d. e. h.	$\frac{9}{16} = 0.562$ in.
$\frac{3}{4}$ to $\frac{1}{2}$ in.	$\frac{3}{4}$ in. d. e. h.	$\frac{11}{16} = 0.688$ in.
1 to $\frac{3}{8}$ in.	1 in. d. e. h.	$\frac{29}{32} = 0.907$ in.
$1\frac{1}{4}$ to 1 in.	$1\frac{1}{4}$ in. d. e. h.	$\frac{1}{16} = 1.125$ in.
$1\frac{1}{2}$ to 1 in.	$1\frac{1}{2}$ in. d. e. h.	$\frac{1}{16} = 1.125$ in.
$1\frac{3}{4}$ to $1\frac{1}{4}$ in.	$1\frac{3}{4}$ in. d. e. h.	$\frac{11}{16} = 1.408$ in.
2 to $1\frac{1}{2}$ in.	2 in. d. e. h.	$\frac{125}{64} = 1.72$ in.
$2\frac{1}{2}$ to 2 in.	$2\frac{1}{2}$ in. d. e. h.	$\frac{23}{16} = 2.187$ in.
3 to $2\frac{1}{2}$ in.	3 in. d. e. h.	$\frac{29}{16} = 2.562$ in.
$3\frac{1}{2}$ to 3 in.	$3\frac{1}{2}$ in. d. e. h.	$\frac{31}{16} = 3.187$ in.
4 to $3\frac{1}{2}$ in.	4 in. d. e. h.	$\frac{31}{16} = 3.688$ in.
$4\frac{1}{2}$ to 4 in.	$4\frac{1}{2}$ in. d. e. h.	$\frac{43}{16} = 4.187$ in.

d. e. h.—double extra heavy. e. h.—extra heavy

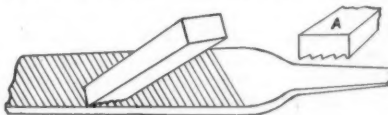
For example, to bush from  $\frac{1}{4}$  in. to  $\frac{1}{8}$  in. get a piece of  $\frac{1}{4}$  in. extra heavy pipe sufficiently long for cutting the outside thread. Then cut the end off to the desired length, drill or ream with a  $\frac{21}{64}$  in. drill (diameter of drill 0.328 in.) and then tap with a  $\frac{1}{8}$  in. pipe tap. That's all there is to it.

This accompanying table tells the complete story for all ordinary sizes. Note that in one case,  $\frac{3}{8}$  in. to  $\frac{1}{4}$  in., the internal diameter of  $\frac{3}{8}$  in. extra heavy pipe is such that no drilling is necessary. Note also that in bushing from  $\frac{1}{2}$  in. to  $\frac{3}{8}$  in. either extra heavy or double extra heavy piping can be used.—S. F. W.

## CLEANING FILES

PERFECTLY good files are often discarded merely because the teeth have become filled with dirt and metal particles, and will no longer cut.

An easy manner of cleaning such files is illustrated, herewith. Use a piece of soft steel with one flat edge anywhere from  $\frac{1}{4}$ -



inch to one inch wide. With heavy back and forth strokes across the file parallel to its grooves, cut teeth in the edge of the steel as shown at (A).

In this manner you have made a tool which now can be used to go over the entire surface of the file in strokes parallel to the grooves in it. The teeth in the tool, which conform exactly to the shape of the grooves in the file, will push all the metal particles and dirt out of the file teeth.

## HERE IS A TRICKY QUESTION HOW WOULD YOU ANSWER IT?

Speaking of fogs and clouds and things which do you think is the heavier—air at 20 percent relative humidity, or air at 50 percent relative humidity?

The answer will be found in the Question Box Department.

## SERVICE KINK AND TOOL CONTEST CLOSED

THE Service Kink and Tool Contest, conducted by this paper, came to a close on December 31, with so many fine entries received that the judges are going to require more time than anticipated to come to a decision.

The work of making copies of each entry and duplicate drawings of each sketch, to submit to the judges, requires considerable time. Therefore, we ask that you have patience with us until such a time as announcement of the winners can be made.

# Refrigeration Service Opportunities in the Beer Dispensing Business

By C. D. McLAUGHLIN, M.E.

THE repeal of the Eighteenth Amendment to the Constitution of the United States has opened a very fertile field for the sale of equipment to control and dispense fermented malt liquor, commonly known as beer. Due to the highly perishable nature of this product and the necessity of careful vigilance to preserve its quality from the time it is manufactured until it is consumed it must be kept under constant refrigeration during this period.

The regulation and control of temperature is of vital importance to beer and ale. For many years the breweries have been using large refrigeration units in the manufacture and storage of their product. At the time of the enactment of the prohibition amendment and the Volstead Act, the use of small mechanical refrigeration equipment in the retail commercial field was practically unknown.

Prior to 1919 ice was the accepted method of cooling beer in the tavern, or wherever it was dispensed on draught or in bottles. In many cases little, if any, cooling was even attempted. The surplus capacity of the large brewery refrigerating machines were utilized to make ice which was distributed by the brewery to the retail customers who bought their product.

Thus at the time the sale of fermented malt liquors and other alcoholic beverages became illegal, the personnel of the brewing industry were not acquainted with the use of small refrigeration units to replace ice. In far too many cases they still remain under the impression that ice is the only acceptable method of cooling beer in the tavern or retail dispensing establishment. Even today, one finds many of the older workers in the brewing industry who still think, and will tell you, ice is essential to the proper cooling of beer and ale.

Sanitary conditions surrounding the dispensing of draught beer were not greatly emphasized before the prohibition era. The

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necessity for cleaning the beer lines and coils through which the beer was dispensed was known, but the methods of doing this were inefficient and antiquated in the light of present day knowledge. The control of temperature to maintain the brewed-in excellence was a more or less haphazard affair. Much less thought was given to the economy of dispensing previous to the return of the legal sale of beer than is now required. Due to the costly restrictions placed upon its manufacture and sale through heavy taxation and high license fees, as well as the increased manufacturing and selling costs, it is now necessary to give very serious consideration to the expenses involved in the dispensing of beer.

In the breweries, all beer is controlled under the strictest sanitary regulations, self-imposed by the industry itself. Temperatures are carefully controlled. Beer, and ale, up to the time it is ready for delivery to the retail dispenser, is, in truth, a quality product. Our responsibility in the matter is to maintain that quality from the time it leaves the brewery until it has been dispensed and is ready for consumption.

The brewers realize this better than anyone else because they know more about the reactions that will take place and the losses that will occur when there is a lack of care or control of temperature, and other necessary conditions, or the surroundings are allowed to become unsanitary. To a great extent, their hands are tied, because of the restrictions imposed upon them through governmental regulations, which prevents them from aiding the dispenser or from forcing him to take proper care of the product should he be inclined to shirk his duty to the consuming public.

## What Is This Product Called Beer?

Beer is a cereal beverage, made from malted barley. It is carefully brewed under the most sanitary conditions, resulting in a product called wort. The finest grades of

hops are then mixed in it to give it flavor and a high tonic value and it is then cooled to approximately 52 degrees F. Pure strains of yeast are now added and the temperature is carefully controlled to maintain an even and thorough fermentation. This fermentation action may continue for several days and when completed the product is cooled to approximately 32 degrees F. and allowed to age or settle. After the aging period is completed it is placed in storage tanks until ready for distribution in kegs to be dispensed as draught beer or placed in bottles or can containers and pasteurized before distribution to the retail dispenser.

Beer is rated high in food value. It is sometimes referred to as liquid bread. As a food, it is often ranked with milk. In addition, there are ingredients in beer that stimulate digestion and aid the appetite, and which help to regulate body functions to promote health. Furthermore, it is a pleasure to drink good beer.

### Size of the Industry

Statistics show that there were more than 700 breweries active in the United States in 1937. There has been very little change in this number during 1938. The manufactured output for 1937 was 55,391,960 barrels (of 31 gallon capacity). Of this amount 32,462,138 barrels were sold as bulk, or draught beer. The remainder was sold as pasteurized beer in bottles or can containers. The bulk or draught beer is not pasteurized and is therefore of a more perishable nature than that which has been treated with the pasteurization process.

Both of these kinds of beer need refrigeration. We will not speak at length of the pasteurized beer here or of the need for refrigeration of this kind of beer because the problem is very much simplified by the act of pasteurization. The temperature control of beer, so treated, is similar to other bottled beverages and it is only necessary that we should emphasize the point that for this kind of beer, dispensed in bottles, cans, or other containers, we must have:

1. Adequate capacity.
2. Close temperature regulation at approximately 40 degrees F. when ready for serving.
3. Proper sanitary conditions surrounding the distribution.

We might mention in passing that about one-half the pasteurized output is cooled and refrigerated with the same equipment

that is employed to cool and control the bulk or draught beer.

Let us pause for a moment to consider the total daily refrigeration load required to cool this immense quantity of beer that is brewed annually. The estimated total average daily refrigeration load required to properly cool the beer sold and consumed will amount to approximately:

Per daily load	
To cool the bulk beer 10 degrees F. ....	24,620 tons
To cool $\frac{1}{2}$ pasteurized beer 35 degrees F. ....	30,525 tons
Leakage and service factor on precoolers for 30 degrees F. temperature difference ....	75,000 tons
Total.....	130,145 tons

### Importance of Field

When we realize that all this may be accomplished with machines of capacities ranging from  $\frac{1}{4}$  ton to one ton we can readily see that there is quite a field for the refrigeration service engineer to develop. It is estimated that there are 300,000 licensed taverns that require refrigeration, and if the average machine were to be a  $\frac{3}{4}$  horsepower unit you will understand the importance of this phase of your business. Other types of business have benefited by the return of legal beer. Innumerable installations for kitchen equipment and refrigeration equipment for restaurants, lunch rooms, night clubs, etc., have resulted from the legalization of the sale of beer. Considerable air conditioning equipment has also been installed because of this same fact.

The sale of alcoholic beverages was made effective in 1933, primarily to bring a much needed revenue to a government on the verge of bankruptcy. The tax derived from this source has been used to help "prime the pump" as the politicians tell us. The restrictions surrounding the sale of this product have been made very severe. This has greatly hindered the business of supplying the correct equipment to properly control the quality of the product while it is in the possession of the retail dispenser.

Among those who entered, or again became active, in the field of temperature control in the dispensing of beer, there was very little knowledge or understanding of the "How" and "Why" of the control of beer quality. Blinded, perhaps by the apparently

huge profits which they hoped to make in this field, many manufacturers of refrigeration equipment lost sight of the need for a thorough knowledge of the problems involved and the care required in the preservation of this highly perishable product.

Most of those entering this field developed equipment on a basis of "price" rather than to build a product that was reliable and practical and which would give the most profitable return on the capital outlay demanded of the purchaser. They failed to take into account this fundamental principle of business that, "The profit motive is the true test of permanence." In the end, nature's law of the survival of the fittest will prevail in active competition. You all know of many of these orphan types of equipment.

Another fact which I am sure all of you service engineers have learned from sad experience is that you just can't make refrigeration equipment do something that it was not designed to do, or right many of the sad mistakes in refrigeration design by simply passing a magic wand over the equipment and saying, "Hokus-Pokus—Acadabra." What you most likely said was, "D—n the man who designed this equipment and the man who sold it also."

#### Factors to Be Considered

There are certain factors which must be considered in the design of any successful equipment:

1. The equipment must be rugged and reliable.
2. All parts of the equipment must be in balance.
3. The system must be complete.

The refrigeration service engineer should know and understand the problems involved in controlling the temperature and quality of beer in the retail dispenser's place of business. From the time that the product leaves the brewery until it is ready for consumption it must be kept under close temperature regulation. It requires study, careful planning, and efficient service to satisfactorily solve the problems involved in beer dispensing. It is suggested that you seriously consider this matter so that you may be able to right the many unprofitable installations now in the field. Furthermore, there is a great opportunity to set up your organization, and its members, as a reliable authority on this subject and thus have the business. You will not only receive the just rewards due your

expert knowledge but you will be rendering a great service to:

1. The entire brewing industry.
2. The retail dispenser of beer and ale.
3. The general public who like a GOOD glass of beer.

Let us consider the requirements in maintaining proper control of beer and ale. There are three important items that must be considered in the profitable dispensing of beer to the customer:

**QUALITY:** Brewers make good beer. It must be dispensed in the condition as made for profitable operation.

**TEMPERATURE:** Forty degrees Fahrenheit seems to be the most satisfactory constant temperature to hold beer from the time it leaves the brewery until it is dispensed or served by the retailer. If too cold when served to the customer he will not consume as much as he would if it were properly served. Too much carbonic acid gas ( $\text{CO}_2$ ) will be retained in the beer if it is kept and served too cold. This gas is released and expanded under the action of body heat and a feeling of stuffiness will then occur which takes away any further desire for more. This means less business. *It is unprofitable to serve beer too cold.*

Beer that is allowed to warm up and then kept in this condition will tend to deteriorate or spoil and it will be difficult to control in dispensing because of the release of  $\text{CO}_2$  gas. The action of heat tends to liberate this gas and the beer acts "wild." This condition, likewise, is very unprofitable.

**ECONOMY OF DISPENSING:** This third item is of vital interest to the retail dispenser. He is in business to make a profit. The economy he obtains in the dispensing of beer will be reflected either as a profit or as a loss. He cannot afford to have it show as a loss. It is much better to serve beer at a profit than it is to lose money in serving it.

The cost of the proper dispensing equipment should be included in the capital outlay required in doing business. Proper equipment will insure profitable operation and will return big dividends.

Do not be swayed by requests to do a "half-way" job. Know the requirements and what the refrigeration equipment will do. Generally, by the time payment is made for the license (the government does not accept time payments either) and a substantial down payment is made on

elaborate fixtures there is apparently little left for the refrigeration equipment or the refrigeration service engineer. Remember this! You are more important to the retail dispenser than elaborate fixtures or even the license. He could have a very modest establishment and might even sell without the legal protection of a license but the people would not come back unless the beer was right.

#### Additional Control Needed

Beer, the product, requires something more than an uncertain temperature control. In order to better appreciate this statement let us consider three different liquids that are generally subjected to refrigeration;

**WATER:** Refrigeration of this liquid for drinking purposes is considered desirable but is not necessary or essential to preserve it from spoilage. Temperature regulation is therefore done to make it more palatable and cause people to drink more water to help wash out the impurities of the body and thereby promote health.

**MILK:** This liquid is subject to spoilage when kept at too warm a temperature and it is therefore necessary to refrigerate it and control the temperature at a point where it will not spoil before it can be used. Milk is considered an almost perfect food and readily sours unless properly handled. Regulation of temperature and sanitary control have become the accepted practice in handling this product.

**BEER:** This liquid is not only subject to spoilage from causes that affect milk but another very important item enters the problem. During the fermentation process the liquid picks up in solution a certain amount of the carbonic acid gas which is formed in the chemical reactions which take place when the sugar compounds are changed to alcohol. It is this gas which gives the tang to beer and which, being acid, opens up the nerves which carry the sense of taste to the brain, thus letting us get the full benefits of the many fine ingredients that make up the good qualities in beer.

It is necessary to control the amount of this CO<sub>2</sub> gas in solution in the bulk or keg beer, as well as the temperature. It therefore requires pressure control as well as temperature control during the time the product is in the retail dispensing establishment, and especially during the operation of setting it before the customer. There is a definite

pressure-temperature relationship affecting the gas content of beer and this should be thoroughly understood by the refrigeration service engineer. It is true that all carbonated beverages are likewise affected by this temperature-pressure relationship, but due to the fact that the bottler controls it when he fills the bottle, and there is little or no action resulting in spoilage due to heat while it is kept sealed in the container, temperature regulation to make it palatable is all that is required.

#### When Beer Spoils

Draught beer readily spoils through refermentation when stored or kept at a temperature above 55 degrees F. to 60 degrees F. The alcohol and carbonic gas in solution retard this action to some extent. That is why the product does not referment and deteriorate under the same conditions as, for instance, milk.

One of the factors required to maintain a uniform taste in any carbonated liquid is to hold the volume content of the carbonated gas that is in solution to a very close range of variation. The carbonation of draught beer (in bulk) is what makes it difficult to handle in the dispenser's establishment. Carbonation is measured in volumes in solution. The solubility of carbonic gas in beers is approximately as follows:

American beers (except such as Michelob) 2½ volumes of CO<sub>2</sub>  
Canadian beers ..... 3 volumes of CO<sub>2</sub>  
European beers ..... 1½ volumes of CO<sub>2</sub>

The brewery engineer maintains a temperature control within two degrees F. to assure the proper volume content of carbonic gas in the beer. It is the amount of this gas in solution which predetermines the temperature at which it should be drawn. We have, therefore, not only to control the temperature during storage and handling to maintain the freshness, but we must continue this control right up to the time the beer is put into the container in which it is to be served.

This is where so many refrigeration systems fail. They are of insufficient refrigeration capacity, or so poorly designed that they cannot meet operating peak conditions and much loss is encountered due to failure to control the gas content as well as the temperature. It is essential to control the volume content of gas in the beer at some constant point or level. The appearance of the product when set before the customer has

an important bearing on his mental reactions as well. While, therefore, an average volume content is put into the product by the brewmaster during manufacture, some of the gas is allowed to escape to form the so-called "head" or collar of foam. When the foam collar is controlled we get a uniform appearing glass of beer and also get a uniform gas content remaining in the beer. This is important.

It is thus necessary to consider, not only a pressure-temperature relationship due to the carbonic gas content, but we must also control that gas content at a uniform level. Charts are available showing this relationship over a wide range of temperature variation. We will set down here a few points within the range of the temperature required to maintain draught beer in a salable condition for a reasonable period of time.

In this table we have shown the variation in the pressure-temperature relationship when the volume content of the carbonic gas is held constant. This is a point that should be thoroughly understood by refrigeration service engineers. You are familiar with pressure-temperature relationships in refrigerants and so this should be simple for you to understand.

Temperature ° F.	Pressure No. sq. in.	Volume Content CO <sub>2</sub>
35	8	2½
40	11	2½
45	14	2½
50	16	2½

### Pressure Regulation

As shown in the Table, to maintain a definite volume content of gas in solution in the beer, we must control, within very close limits, both the pressure and the temperature conditions to which it is subjected. Provided we can maintain control of the volume content of the gas in the beer at 2½ volumes, it is possible to deliver it to the glass in this condition. When we also maintain temperature control on the beer until it reaches the glass we are assured of a condition which will give us a means of controlling the foam collar. Many different conditions must be satisfied to enable us to control the collar of foam and even though we comply with all of them the person who draws the glass of beer can upset our successful operation by drawing it improperly.

Due to the necessity of maintaining a pres-

sure balance on the entire system that dispenses draught beer a thorough understanding of the actions and reactions of beer under varying conditions should be understood by the Refrigeration Service Engineer. A great deal has been written on this subject. It is unfortunate that so much that has been published has been written by those who did not take the trouble to apply fundamental principles to their reasoning.

The control of pressure on the beer to balance the system is complicated by the fact that the gas in solution in the beer varies in volume as the temperature varies. This gas is evolved naturally in the process of fermentation in quantity more than sufficient to give the required content for palatability. It is soluble in liquids in varying quantities as the temperature of the liquid is varied. It is, therefore, not difficult to over-carbonate the beer or have an insufficient amount in solution when we do not properly control the temperature. Two different schools of thought have developed on this point alone. One insists that the pressure balance necessary to maintain the constancy of the gas volume in the beer and to balance the pressure in the dispensing system must be accomplished by the use of this same carbonic acid gas. The other insists that air must be used to prevent over-carbonization and for economic reasons. We will not discuss the merits of these claims here, but it behooves you to know and understand them. The only advice or counsel that will be offered here is this: *After you have made a thorough study of both sides of the problem you should then be guided by good judgment and experience.*

### Beer Dispensing Systems

Systems used in beer dispensing may be enumerated under two general classifications:

- (a) Temperature regulating equipment.
- (b) Pressure regulating equipment.

Under the temperature regulating equipment we find:

1. Ice.
2. Mechanical refrigeration.

Under pressure regulating equipment we find:

- (a) Carbonic gas (CO<sub>2</sub>) in drums or containers under pressure. This pressure is reduced through regulating valves to that required to balance the pressure exerted by the carbonic gas in solution in the beer.

(b) Air pumps. Either mechanically operated or hand operated pressure mechanism for supplying the air under pressure to balance the pressure exerted by the carbonic gas in solution in the beer.

This leads us into the third phase of our subject, or the service and installation requirements—problems—and remedies in retail beer dispensing. The refrigeration service engineer is the key man in this picture. They made the locks but they never did give him the keys. He should insist on his rights. Get the keys. By that I mean the information necessary to operate the locks. You will not only be serving the brewing industry—the retail dispenser of beer—and the beer consuming public, but you will also open up a source of lucrative revenue or plus business for yourself.

### Suggested Sources of Information

First, it is my advice that you should visit the breweries that are in your territories. Find out how beer is made and, what is very important, how much they value temperature regulation while the product is manufactured. You will notice there a curious item. Two different thermometer scales are used in a brewery—the Fahrenheit, with which you are all familiar, and the Reaumur which was the original thermometer used in brewing beer. The latter has a scale of 0 degrees R. to 80 degrees R. between the melting point of ice and the boiling point of water. Thus when they speak of a fermenting temperature of 9 degrees they mean 9 degrees R. and this is equivalent to approximately 52 degrees F.; or when they speak of an aging temperature of 0 degrees R. it is equivalent to 32 degrees F. You will not need to use the Reaumur thermometer in your work but it is well to know the language of the brewmaster.

The purpose of this suggested visit is to realize the great investments involved in brewing beer and to what length they go to make a quality product. Then when you come in contact with some of those puny inadequate machines that have been put on the market to take care of this product in the retail dispenser's place of business, you will better realize the immense task you have ahead of you to set the business right and put it on a paying basis. You will also be better qualified to discuss a fair compensation for your efforts after seeing the importance of controlling this product until it is set before the customer.

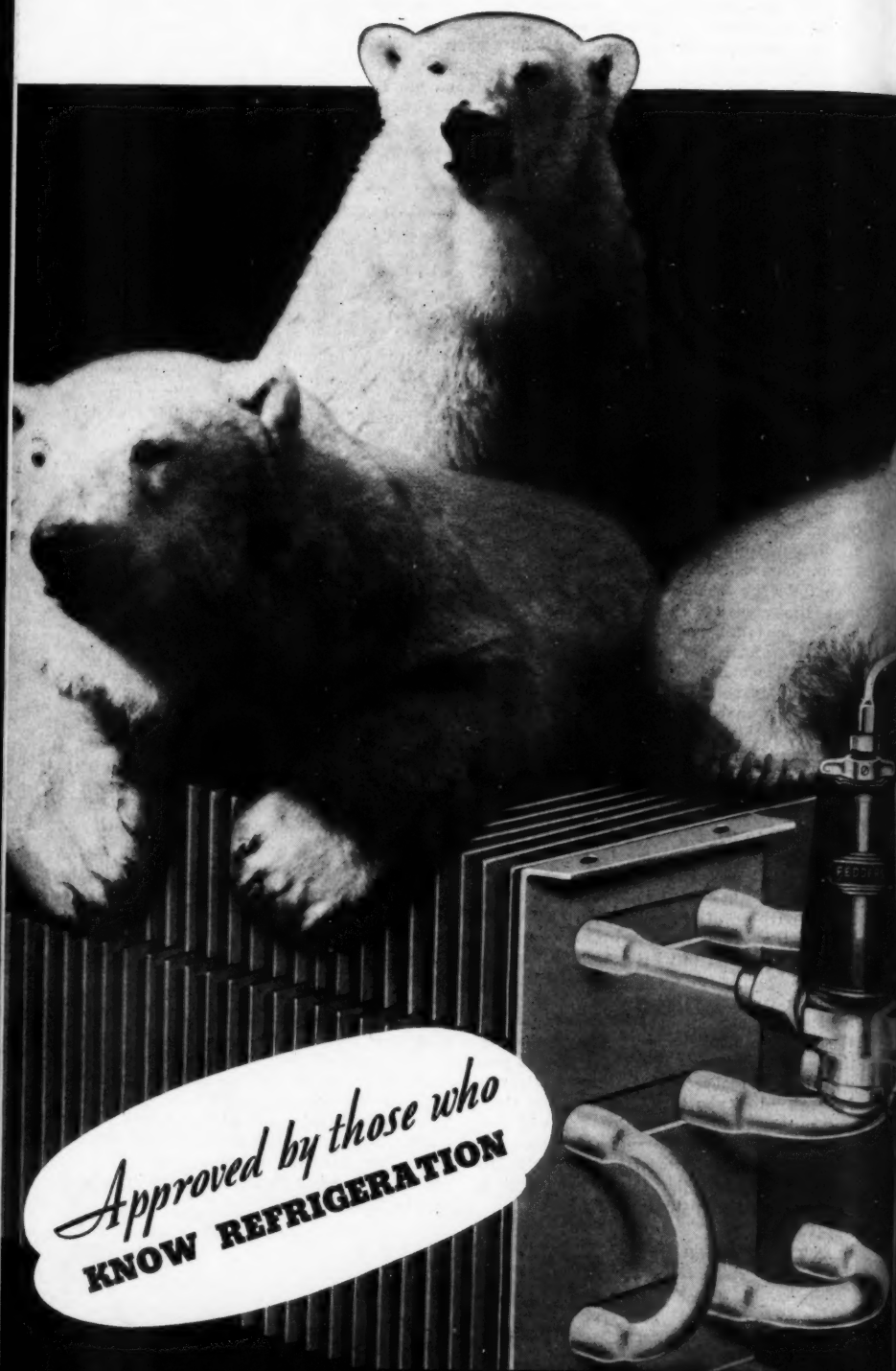
You will find in the necessary equipment to economically dispense beer, many other things besides refrigeration service that you can offer the tavern keeper to enable him to make money. When he increases his profits as a result of your labors he should not quibble about sharing some of it with you. *The soundest basis on which a retail beer dispenser should operate is to have a complete beer dispensing system.* He will pay \$1,000 for a license (he has to pay cash because the government does not trust him to make a success of the business) and he will purchase elaborate fixtures and glassware. He is compelled by legal restrictions also to pay cash for beer. Then he will try to buy the cheapest kind of temperature and pressure regulating equipment. He will even go so far as to try and omit as much of this as possible. What chance have you got to make the darn thing work if most of the gears and wheels are left out.

### Service and Installation Requirements

A complete beer dispensing system for the retail dispenser should consist of:

1. A precooler.
2. Insulated and refrigerated beer lines.
3. Suitable means of balancing the beer pressure.
4. Good faucets.
5. Reliable pressure apparatus.
6. Good air connections and reliable fittings.
7. Tap rods, pressure gauges, etc.
8. Refrigeration equipment—that is reliable and of suitable capacity.
9. Cleanliness and sanitation—a very important item of which is the cleaning service required for the dispensing system.
10. The most important item of all is good service.

You will, no doubt, be called upon to do the regular refrigeration installation work. You should make it a point to see that you get it. That is your right and you should demand it. You should be qualified to do the entire work of installing the dispensing equipment. Why not make a complete job of it. Learn all about this business and set yourself up as the reliable and responsible authority in your community to do this work. In order to do this you will have to sell your ability to the brewing industry and retail dispensing industry so that you will be sought after when there is such an installation to be made.



*Approved by those who*  
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There are many problems to be understood. In a great number of cases you will encounter the task of trying to make an under-capacitated and inadequate system do something it was never designed to do. When you have built a good reputation and you speak with authority your advice will be heeded. You can do much to raise the present level of performance of refrigeration equipment and beer dispensing equipment in the retail beer business.

Beer service problems may be divided into three general classes:

1. Draught—The manner in which it is drawn.
2. Appearance—The appearance after it is drawn.
3. Taste—To the Customer.

Under this third item are several subdivisions as follows:

- (a) Foamy Beer.
- (b) Flat Beer.
- (c) Cloudy Beer.
- (d) Bad-tasting Beer; sour; refermented; etc.
- (e) Loss of control of foam texture.

Even though the dispensing equipment is satisfactory in every respect, the bartender can cause trouble by drawing it improperly. These fellows think they know and are supposed to know their business. To remedy such troubles you will have to use diplomacy. You will have to know how to remedy the trouble and then win the confidence of the man who operates the dispensing equipment. Let him know *you know* how to control beer and then make him feel you are there to help him, not to "show him up."

#### Appearance of Beer Important

The appearance of the beer when set before the customer is important. It may have been carefully drawn and the dispensing apparatus may be adequate but it does not have a wholesome and appetizing appearance. If this is caused by the container in which it is served or the person who draws it they have no right to blame it on the dispensing equipment. Clean glasses and sanitary surroundings are very important. Beer cannot retain its rich creamy head of foam in a dirty or greasy glass. Don't try to remedy such trouble by adjusting the refrigerating equipment.

Taste, to the customer, is very important. If the beer tastes right he will come back for more. If it does not taste right the retailer

can expect to lose a customer. Controlling the taste is done by controlling the quality and excellence and maintaining it as it was brewed into the beer by the brewmaster. We have already spoken of what constitutes quality and how it is brewed into the beer. To understand what this means it is necessary to know how beer is made. To know how to maintain this quality requires a thorough knowledge of the application of refrigeration to the product and the function of each part of the dispensing equipment.

#### Further Suggestions

It would be impossible, and presumptuous on my part, to try and give you the complete story here. May I offer the following suggestions for your consideration:

1. Learn the fundamental principles governing the manufacture and control of beer.
2. Learn how to judge the real facts about how to control the quality during dispensing from the great mass of mumble-jumble that has been printed and distributed.
3. Don't mess around with apparatus that you or anybody else can not make work.
4. Build a reputation for being able to help the beer dispenser operate his establishment profitably and then maintain that reputation at all times.
5. Get that business for yourself and make a profit out of it.
6. Co-operate with the brewing industry—they need your assistance. You will be surprised when you find many of the "old timers" who don't even know there is such a thing as a refrigerating machine for the retail dispenser.
7. Get acquainted with the representatives of the brewing industry who call upon the retail dispensing trade. I mean beer salesmen and brewery truck drivers. They are in the dispenser's place of business almost every day. If they know you and your reputation for service in the beer dispensing field they are going to see that you get this business.
8. There are two fundamental things wrong with the way most beer is served today—it is either too warm or too cold. Refrigeration service engineers—you hold the keys to the solution of the problem. Unlock the door to progress and success.

## The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box."

### ANSWER TO QUESTION CONTAINED ON PAGE 25

HERE is the answer given by Mr. George H. Clark to the question contained on page 25.

Referring to the Psychrometric Chart, you will find specific volumes of air given in terms of cubic feet per lb. for both dry and saturated conditions. You will note that the volume of the saturated air is greater than the volume of dry air, and consequently, the weight of the saturated air would be less than the weight of dry air. In other words, the higher the relative humidity, the lower the specific gravity of the air.

\$\$\$

### CALCULATING FIN EVAPORATORS

QUESTION 291. In your September issue, under The Question Box section, question No. 220, you explained how to calculate pipe evaporators by giving the formula to calculate the heat transfer for pipes.

We are, however, very much interested in knowing the way to calculate fin evaporators for low and normal refrigerator temperatures.

If you are not in position to supply us this information, we would appreciate very much if you could tell us of any technical refrigeration book or books where we could get this information.

We have been manufacturing our own evaporators using, as basis, several evaporator manufacturers' specifications, but they all seem to have different ways and methods of calculating their B.t.u. load.

ANSWER: With respect to a method for calculating fin evaporators for low and normal refrigerator temperatures, I would simply work on the idea that we get approximately two B.t.u.'s per square foot of coil surface per degree difference in temperature between the coil surface and the air passing over the coil surface. For nor-

mal temperature refrigerators where the fins are well bonded to the tubes and where the distance from the edge of the fin to the tube is not extreme; that is, more than 2 inches and with a normal size condensing unit, I believe that we may figure the refrigerant temperature will be from 5 to 10 degrees lower than the average fin surface when the condensing unit is operating.

When the condensing unit shuts off the refrigerant will warm up to very nearly the same temperature as the fins. For low temperature refrigeration I would normally recommend a plate type of coil as with the fin type of coils, the effectiveness is destroyed when the fins frost up appreciably cutting down the air circulation as well as giving a warmer heat transfer surface.

A number of manufacturers supply the plate type coils. One of the decided advantages of the plate type coil is that the frost may be scraped off periodically with a flat blade of some sort without requiring the coil to be warmed up above frost temperatures. The same method of figuring heat transfer would apply with the plate type of coil as with the fin type of coil. However, the plate temperatures may be somewhat closer to the refrigerant temperature while the machine is operating than the fin.

### EUTECTIC SOLUTIONS

QUESTION 292. I should appreciate it very much if you could give me a specification eutectic solution, and the latent heat of it, which will freeze at the following approximate temperature in degrees F. 40, 20, 10, -0, -5, -10, -20.

Do you believe it necessary to take special precautions in tank construction (using eutectic solutions) in regard to the expansion of the frozen solution?

ANSWER: With respect to a list of eutectic freezing solutions with the various freez-

ing points mentioned, I do not happen to know of any solutions which freeze at those temperatures exactly. I believe, however, that the following list gives a fairly complete coverage on solutions with eutectic freezing temperatures from plus 30 to minus 60. The list of solutions, their percentages and freezing temperatures are as follows:

SOLUTIONS	PERCENTAGES	FREEZING TEMPERATURES
Sodium Sulphate.....	4.9	30°
Potassium Sulphate...	6.5	28.3°
Sodium Carbonate....	8	28°
Potassium Nitrate....	11.5	26.6°
Potassium Chloride....	19.7	12.8°
Ammonium Chloride..	19.1	4.3°
Ammonium Nitrate...	42.8	2°
Sodium Nitrate.....	39.7	.6°
Sodium Chloride.....	23.3	-6°
Potassium Carbonate..	35.5	-34.7°
Calcium Chloride.....	32.4	-59°

With respect to the latent heat of the solutions, I believe the safe way is to consider the latent heat of 144 B.t.u.'s per pound for the total number of pounds of water used. All solutions, by the way, are based on weight measurements.

With respect to tank construction, I believe that it may be found most practical to use a refrigerating coil located in a tank in such a way that when the solution freezes it freezes in the center of the tank and toward the outside. If the control can be so set as to stop the machine before the tank is frozen solid there should be no danger due to expanding the tank.

#### REFRIGERANT DRIERS— XYLENE IN HERMETICS

QUESTION 293. (1) In reading the article "Refrigerant Driers" in your March issue, I note in the tests made, the drier was more efficient when used to dry out the vapor. If a drier is placed in the suction line, would the size of the drier have to be different than that recommended for the same system by the manufacturers, when used in the liquid line?

(2) Also, can Xylene be used in a hermetically-sealed unit without injury to the motor windings, and will it dissolve the gasket material used so extensively?

ANSWER: In using a drier on the suction side of a system, it would, of course, have to be somewhat larger than what can be used on the liquid line.

However, the standard makes on the market are usually suitable for this purpose, providing you use not less than a two-inch diameter drier for suction lines up to 1/2-inch diameter. The connections on the inlet and outlet, of course, would have to be increased to the same size as the suction line.

A further precaution to take in this use is that the drier should be installed in the vertical position, with the inlet at the top, which will permit the oil to be blown down through the drier without trapping or being held within it.

Xylene is used in the paint industry considerably as a solvent, and, therefore, it seems quite probable that it may do harm to some of the parts in hermetically-sealed units. For instance, Neoprene products, such as the packing used in compressor seals and some gasket materials, will soften slightly with Xylene. I believe Neoprene is also used in hermetically-sealed units in some cases, as a sealing compound around the motor leads entering the unit casing. While the softening is slight, it will, no doubt, over a period of time, cause leaks at these points. It doesn't seem advisable to use such products in the manner in which you suggest, since there is no substitute for a properly cleaned system containing nothing but pure gas and oil.

#### DISPLAY CASE TROUBLE

QUESTION 294. My problem was published in the January issue of THE REFRIGERATION SERVICE ENGINEER—Question No. 235. I followed your suggestions, but without much success. At the pressures suggested, the coils defrosted, but the box air rose too high.

I think that the trouble is in the finned coil in the display section. Referring to the diagram in the January issue, the end of the coil, marked "no frost," does not frost at all, even during the "on" cycle; therefore, the coil is only working at about 50 percent efficiency. Why should one end of the coil frost from top to bottom, and the other end not, since the refrigerant must travel from end to end lengthwise? The plain tube coil in series with it acts normally.

Don't you think this lack of refrigeration causes long running time and excessive refrigeration in the storage compartment?

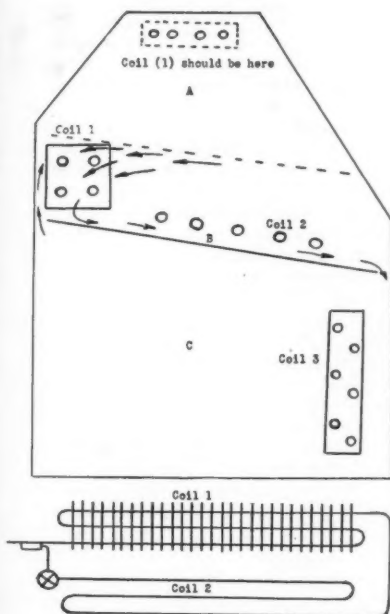
Now, if the air temperature in the storage compartment is held at 32 degrees or lower, as the dealer said could be maintained, how can this coil defrost as it should with the air temperature below freezing?

If you can tell me why the display coil does not frost the complete length during the "on" cycle, the trouble would be licked.

Do you think a two-temperature valve on the storage coil, and a higher air temperature (34 degrees to 36 degrees) in that compartment would help any?

Several other servicemen have worked on this job without success.

ANSWER: If I understand your layout of this display case correctly, the coils are located as shown in the accompanying sketch. In this sketch, you will note that for con-



venience in referring to it, I have marked the three temperature areas as A, B and C, and the coils as (1), (2) and (3). The layout is such that very poor circulation is obtained in the upper part of the case, and the greater part of the load is thrown on coil (1). The arrows indicate the probable path of circulation, and as may be seen, the area A above the dotted line will receive very little refrigeration since there is no circulation there. Area B, under the plain pipe coils, will probably be at the desired temperature, and area C will be very cold, and if the baffle between the storage compartment and the display section are circu-

lation openings as shown, then coils (1) and (2) are supplying refrigeration to section C, thus throwing the greater part of the load on these two coils. With the coils in this location, it would be impossible to obtain proper temperatures in the display section above the food pans.

The fact that your original sketch settings were so low indicates an effort on the part of some other person to force the system, and try to obtain the desired temperature. Lowering the switch settings, however, until frost accumulates, will in most cases do more harm than good, since the heat absorption of the coil is reduced very rapidly with the accumulation of frost. The frosting of one end only of coil (1) may be due to two things—to opening of the service doors more frequently on the end that does not frost, and to better circulation at this end of the coil. Poor refrigeration will be obtained in this coil due to the fact that the thermostatic bulb is placed on the end of the plain tube coil (2), which is the coldest point of this section, and coil (1) is, therefore, controlled by the temperature of coil (2). Since coil (2) will accumulate a certain amount of cold liquid gas, and will probably remain frosted at all times, coil (1) will be starved of liquid the greater part of the time because the expansion valve will be held closed by the temperature of coil (2).

In a display case of this type, the fin coil (1) should be installed in the top of the display section, the expansion valve should be connected to the highest end of coil (2), so that gas and oil will flow downward through coil (2) into the top of coil (1). The thermal bulb should be on the lower end, or outlet, of coil (1).

Since in this case coil (1) may be too large to fit into the space in the top of the display section, and would necessitate the purchase of a new coil, your customer may not care to go to this expense. If such is the case, I can only suggest that you make the changes in the hook-up described, and endeavor to secure the proper temperature in operation with coil (1) in its present location.

#### GENERAL ELECTRIC AND KELVINATOR PROBLEMS

QUESTION 295. I have a General Electric hermetic DR2. This model has a round evaporator about one foot long, with a pipe connection at bottom and top of evaporator. There are two 1/4-inch connections at top,

connected to a tee. One piece of pipe is pinched and folded over. To one side of the condenser is a float, if I remember right. This has a nut over the top, and threaded on outside of the stem inside of this opening is a special plug or screw. I believe this is a charging connection. I am going to attempt charging this unit with  $1\frac{1}{2}$  quarts of Argon oil and  $5\frac{3}{4}$  lbs. of  $\text{SO}_2$ .

How is a vacuum pumped on this machine, and where is the vacuum gauge connection? How is this job purged, and how many turns will the charging valve have to be turned to charge? Isn't liquid charged to this type of unit? How large a quantity is charged at one time?

I have a Kelvinator high side float system in mind. I have had several calls on the evaporator not frosting all the way to the top. During hot days, it seems that most of these jobs operate under about 90 lbs. head pressure, with a condenser filled with dirt. I have an idea under such weather conditions and filled condenser, that it may be the right amount of gas is not being condensed due to the dirty condenser; therefore, leaving a shortage for the evaporator. The gas leaving the top of the evaporator being superheated about 10 or 15 degrees causes no ice to form. The ice forms to about  $2\frac{1}{2}$  inches from the top. I have added  $\text{SO}_2$  and the frost seems to appear all the way up. These machines are domestic, about six years old, and work okay otherwise.

For domestic use, what type of expansion system do you believe is the most practical—high side float, low side float, thermostatic expansion valve, or automatic expansion valve, using the proper type of evaporator in each case to conform with the type of refrigerant control?

ANSWER: All service operations on the G.E., such as charging, evacuating, etc., must be done through the charging valve, which is located on the top of the float.

It will be necessary that you secure an adapter, which will fit in this connection, and attach, thereto, a tee and your gauge for the purpose of pulling a vacuum and charging. The vacuum would have to be pumped by a separate machine, connected to this purge valve. Immediately a vacuum is drawn, the purge valve may be closed until such time as you disconnect the vacuum pump and connect in its place, a small drum of gas. Liquid should be charged into the system, and this float is so arranged that when the purging valve in the top of the float is turned out approximately four turns,

it opens the float valve directly into the evaporator, permitting the liquid to go through the float rather than backing up into the condenser. I would say that on the first charging, approximately 5 lbs. of  $\text{SO}_2$  could be allowed to enter; thereafter, a charge in quantities of approximately two to three ounces at a time, permitting the machine to run inbetween charging periods. It is possible after you have reached a complete charge in the machine, there will be some air to be purged out. This purging is again done through the charging valve on top of the float.

### Kelvinator Trouble

In regard to the Kelvinator trouble you are having, all high side float systems will show a partly defrosted condition of the evaporator when they become low on gas. The condition of the condenser, or of the weather, does not have sufficient effect that it would show on the evaporator itself. A high side float system that has been fully charged during warm weather, and with the condenser dirty, may show a slightly longer frost line on the return line during cool weather, or after the condenser has been cleaned. This is due to the fact that more vapor will be held in the condenser at its higher operating pressure. The amount of difference, however, would only represent possibly two or three inches extension of this frost line.

I believe that every man might have his own personal opinion as to what type of expansion system is the best. Certainly, a lot can be said for each of them, and to get into a discussion of their individual merits would require considerably more space than is practical here.

\*\*\*

Frank G. Sampson,  
California

I have received THE REFRIGERATION SERVICE ENGINEER since the first of the year, and will say that I do not want to be without it—I get so much out of it.

Charles Dean,  
Idaho.

Enclosed please find a money order for \$2.00 for THE REFRIGERATION SERVICE ENGINEER for the coming year. It is a fine magazine, and I read it every month. I especially like the Question Box and service data on new models.

# The New Electrimatic Suction Throttling Valves

Their use, operating characteristics, and adjustment

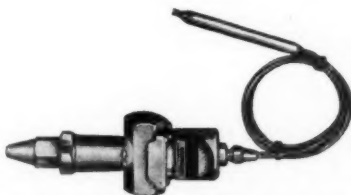
BY HAL WEIR McPHERSON, E.E. \*

THE possibilities of the use of suction throttling valves to protect evaporators from freeze-ups or undesirably low temperatures are so attractive that it is surprising that they have been so long neglected.

The new Electrimatic Suction Throttling Valves are of two types. The type RT is temperature actuated and has a small temperature bulb on the end of five feet of capillary tubing. This valve has the appearance of a big expansion valve and to a certain extent that is just what it is, with the exception that its major use is on the suction line.

Just how the RT works can best be shown by an example. Suppose we have a sweet water bath on a multiple installation. The low pressure switch is set to open at 18 degrees F. It is quite obvious that there is danger of freezing the bath before the other loads are satisfied. To prevent this freeze-up we install a type RT suction throttling valve in the suction line from the coil in this bath at any convenient point before the line joins the main suction line. The bulb is now immersed at the coldest point

this position its resistance to flow is only that of an open globe valve. The orifice will remain wide open until the temperature for which it is adjusted is reached. In the present example let us say that the valve is adjusted to protect a 40 degree bath. If the temperature of the bath falls below 40 degrees F. the capacity of the suction line will be reduced by the closing or throttling of the RT in accordance with the table.



THE NEW SUCTION THROTTLING VALVE

A little study of the foregoing table will indicate why it is often preferable (in baths having erratic loads) to clamp the RT bulb to the evaporator coils in the bath.

The adjustment of the valve can be such, for evaporators not requiring full  $\frac{5}{8}$ -inch O.D. suction line capacity, that complete shut off may be effected at a much higher temperature than shown in the preceding example. For instance, if  $\frac{1}{2}$ -inch O.D. tubing is ample in size the valve may be set to be wide open at 58 degrees F., hence, only 50 per cent open at 40 degrees F., thereby assuring tight shut off at 28 degrees F. Other conditions can be calculated in like manner from the table.

Adjusting type RT is quite simple. Remove the bottom cap (use two crescent wrenches) and the adjusting stem is exposed. With a speed wrench turn the stem in (clockwise) to raise the wide open temperature. Turn out (counter-clockwise) to lower.

The type RT is available in three different temperature ranges so that it is applicable

Temperature of Bulb	Below Full Open Setting	% Suction Line Capacity
40° F.	0° F.	100%
38° F.	2° F.	90%
35° F.	5° F.	80%
33° F.	7° F.	72%
30° F.	10° F.	56%
25° F.	15° F.	48%
20° F.	20° F.	20%
11° F.	29° F.	0%

(The two right-hand columns are in general true of all three temperature ranges.)

in the sweet water bath and is frequently fastened to the evaporator.

The cycle of operation is as follows.

When the machine starts up the bath is warm and the RT valve orifice is wide open. In

\* The Electrimatic Corp., Chicago, Ill.

to air conditioning and water cooling, commercial refrigeration, and low temperatures (ice cream, etc.) It has many applications other than the prevention of baths freezing up. One of the commonest of these applications is on the suction lines of fan-type unit coolers or cold diffusers, as they are sometimes known. In this application the bulb is taped to the suction line.

Any number of different evaporators on a central system may be controlled by their own separate RT suction throttling valve.

The second type of Electromatic Suction Throttling Valve is the RP. This type is pressure actuated, and the actuating feeler line is commonly run to the evaporator it is intended to protect. The RP is also furnished in three different temperature ranges and is adjustable in the same manner and over the same ranges as the RT. In general appearance the RT and the RP are the same except for the temperature bulb and the capillary tubing. The general performance table given for the RT can also be applied to the RP by converting evaporator temperatures to evaporator pressures.

§ § §

## AIR CONDITIONING PLAYS IMPORTANT PART IN BUILDING OF GIANT PALOMAR TELESCOPE

**S**UCCESS or failure of this world's attempt next year to be a "Peeping Tom" on its neighboring planets depends today upon the faultless accuracy of three telescope gears being ground now in a special air conditioned bungalow at the California Institute of Technology.

These gears, weighing eight tons each but tiny in comparison to the famous \$15,000,000 Palomar telescope on which they will be used, are being ground so slowly and carefully that they will take a year to be completed.

Each tooth of the 720 on each gear must be accurate because they will train the giant eye on the skies when science is ready for its latest effort to locate life on the moon and Mars. The binding of the gears or slightest lurch caused by faulty grinding and the costly 200-inch lens and telescope will be useless.

To obtain this accurate grinding, scientists at the California Institute of Technology must have constant temperature conditions. To maintain this temperature, the special air conditioned bungalow was built inside a huge machine shop and tests showed that air tem-

perature did not vary more than  $\frac{1}{2}$  degree in 24 hours.

The bungalow will have a constant night and day temperature of 75 degrees Fahrenheit. This is provided by a Carrier air conditioning system with special filters and sensitive thermostatic controls. These controls are really the "watch dogs" of the temperature.

The necessity for constant temperature is in the spacing of the gear teeth. If the entire gear were not kept at a constant temperature, accurate spacing of the teeth would be impossible. Teeth gashed in a colder part, for example, would be too wide after subsequent normal heat expansion. In addition, the shaft holding the gear cutter is kept at constant temperature with running water. A Carrier air conditioning expert takes temperature readings constantly.

The gear cutting job, considered the most important present activity in the telescope construction, is directed by G. W. Sherburne under the supervision of Dr. John A. Anderson. Each of the eight-ton gears will measure about  $14\frac{1}{2}$  feet in diameter, but now they resemble a giant locomotive wheel.

The telescope and observatory, erected for the Institute by the Rockefeller Foundation to be used at Mt. Palomar (near San Diego), has been five years in the making. It will penetrate space eight times as far as the present 100-inch Mt. Wilson eye.

The new 200-inch telescope will magnify objects to 1,000,000 times the size they appear to the naked eye. This will bring the moon within 20 miles of the earth and make any medium-sized building on the moon visible. If Mars has cities and cultivated fields, the "eye" will disclose them.

§ § §

W. H. Taylor  
California

Just a word regarding your fine magazine, **THE REFRIGERATION SERVICE ENGINEER**. I believe it is the finest magazine of its type on the market.

John Neives  
British West Indies

For your information, I must state I am pleased with your publication; also, the prompt mailing, and further state your instructions and all responses to questioners are quite helpful. I shall always recommend same to anyone who I may know is interested, and wish your publication all success.

FOR PEAK PERFORMANCE



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up to*

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UNITS AND  
AIR CONDITIONING EQUIPMENT**

**A**LL WRAPPED UP in one compact package, PAR hands you the kind of performance you can rely on—the kind you want to give your customers . . . PAR Units are noted for high capacity, and dependability that reduces service calls and increases customer satisfaction.

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- Slow speed, large capacity compressors, crankshaft-driven.
- Three-ring pistons; removable compressor valve plate.
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- Completely assembled and wired, ready for installation.

PAR air-cooled unit, shown above, is made in six sizes,  $\frac{1}{4}$  to 2 H.P.; for Freon-12 or methyl chloride refrigerants. Three optional speeds for low, standard and high temperature applications.

**MODERN EQUIPMENT CORP., Defiance, Ohio**

# R. S. E. S. Day at the All-Industry Refrigeration and Air Conditioning Exhibition

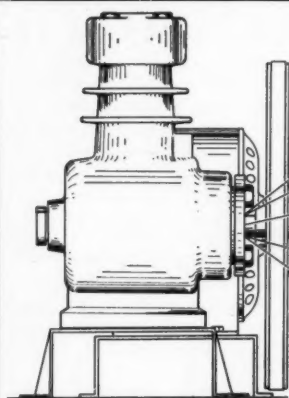
Illinois State Association to Hold Meetings January 18

**U**NDER the sponsorship of the Illinois Association of the Refrigeration Service Engineers Society, Wednesday, January 18, has been set aside as R.S.E.S. Day at the all-industry Refrigeration and Air Conditioning Exhibition, Stevens Hotel, Chicago, January 16-19, 1939. Mr. Eugene H. White, of Elgin, chairman of the General Committee, reports that a full day's program for both the refrigeration service engineers and their ladies has been arranged.

Personal invitations have been extended to members of all affiliated R.S.E.S. Chapters within a radius of 800 miles of Chicago to join the Illinois members in the events for a big R.S.E.S. Day. Through the presidents of the more distant chapters similar

invitations are being extended to all refrigeration service engineers likewise to attend all of the four separate events which will make up the program for the day.

Directed by Mr. Willis Stafford of Aurora, program chairman, the day's sessions will begin at 10:00 a.m., with a unique program made up of addresses and discussions on ways and means of improving the organization work in local chapters. How to get new members, hold their interest and get them to meetings—program building, selecting suitable subjects and capable speakers—financing chapter work—these and many other subjects of vital interest will be considered. Officers and committeemen of duly accredited R.S.E.S. chapters will take part.



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for Once and for All**



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cally All Makes of Compressors.**

**At New Low PRICES.**

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**SYNTRON CO., THOMAS BLVD., HOMER CITY, PA.**

All members of such chapters will be welcome to "sit in" and listen.

A luncheon meeting will be held at noon, followed by a most interesting afternoon session, with a big party and dance in the evening. The Ladies Entertainment Committee already has made arrangements to provide an equally interesting and varied program during the day for the ladies.

In the invitations which are being extended by Mr. Leonard C. Nelson, president, and Secretary White, all members are being urged to reach Chicago, however, in time for the big all-industry banquet on Monday evening, January 16; then to spend the following day taking in the exhibition itself, thereby getting the greatest possible good from the volume of information which may be had through inspecting the exhibits, seeing the various motion pictures, and hearing the lectures to be given by the manufacturers in the two exhibition theaters, which are adjacent to the display floor. In these smaller convention halls, the exhibitors will be putting on throughout the day continuous programs.

There is no charge for the exhibition or any of its features. However, there will be a modest registration fee of \$2.50 for the

Illinois Association meeting. This fee will cover the expense of the meeting, the luncheon, and the dance in the evening. Admission to the dance only will be \$1.25.

During the time of the exhibition, the Illinois service engineers will maintain open house in a large booth in the Exhibition Hall, where the out-of-town members will be welcome to make their headquarters.

Other events of the week will include the Fourth Annual Meeting of the National Refrigeration Supply Jobbers Association, the annual meeting of the Refrigeration Supplies and Parts Manufacturers Association, a meeting of the Mid-West Section of the American Society of Refrigerating Engineers, and the first national meeting of the Air Conditioning Dealers and Contractors Association.

On Monday evening, January 16, the first all-industry banquet will be held. Highlights from the tentative program for the evening will include such noteworthy speakers as: Mr. H. W. Burritt, vice-president in charge of sales, Kelvinator Div., Nash-Kelvinator Corp.; Mr. L. R. Boulware, vice-president, Carrier Corp.; and Dr. Gardner Poole, vice-president, Frosted Foods Sales Corp. and incoming president of the A.S.R.E.



## **"Chieftain" Quality Built Compressors and Condensing Units**



are designed to give you many years of quiet, efficient and trouble free service by Engineers who have been serving the refrigeration industry for the last fourteen years.

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Mechanical improvements include, force feed lubrication to piston pin and connecting rod bearings, positive alignment of cylinder bores with main bearings by casting cylinders and crankcase in one piece. Adjustable suction shut-off valve, interchangeable parts with single and twin cylinder models. All compressor parts are machined to precision limits on up to date equipment and assembled in glass enclosed rooms where only filtered, dust free air is admitted.

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# REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.



## THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

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Directory of Chapters Continued on Next Page

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Nye, 80 Ontario St., Toronto, Ont., Canada.

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tel. President, R. C. McCarthy; Secretary, E. J. Seaton,  
3214—10th St., Rockford, Ill.

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**YOUNGSTOWN CHAPTER NO. 1, YOUNGSTOWN,  
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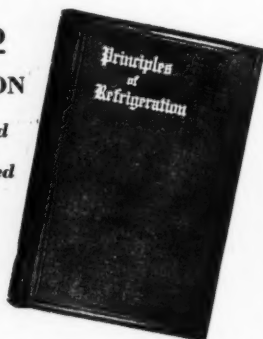
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The work is in everyday language, and as free as possible from higher mathematics. The method of treatment has been to present a comprehensive treatise on the fundamental principles. With a firm grounding of these fundamental principles, the practitioner is enabled to intelligently design or operate refrigerating machinery. The theoretical and fundamental operating principles are given attention first. This is followed by numerous practical considerations and the application of the fundamental principles to the economic production of ice and refrigeration for various purposes.

The author has drawn extensively on his wide experience as a refrigeration engineer and teacher of refrigeration engineering, for materials for this work.

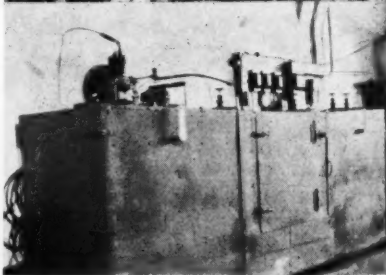
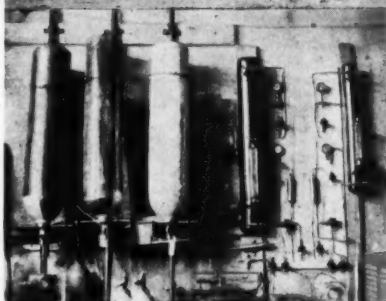
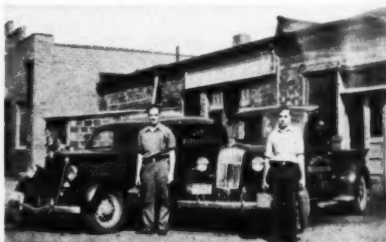
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## MASON CITY REFRIGERATION COMPANY MAKES PROGRESS

**I**N 1923, Mr. Dallas Comstock and Mr. H. A. Ward, both of whom are members of the Refrigeration Service Engineers Society, organized what is now known as the Mason City Refrigeration Co., in Mason City, Iowa.

In the years following to the present date, they have enjoyed a healthy growth in business each year until now they can boast of the best equipped shop in northern Iowa.



**MASON CITY REFRIGERATION CO. SHOP  
AND TRANSPORTATION EQUIPMENT**

In the upper picture are shown (right) H. A. Ward and (left) Dallas Comstock, owners of the company, with the trucks used in their work.

Center—A view of the charging board and drum stand built by the owners.

Bottom—The drying oven also built by the owners.

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Specializing in commercial service and the sales of Ehrlich and Koch refrigeration equipment, and Mills and Brunner compressors, they now cover a territory of ten counties in northern Iowa. They have several contracts for service, the most important of which is with Mills Novelty Co. on their ice cream freezers.

They have built most of their shop equipment, and as can be seen in the accompanying views, have a very fine drum stand, charging board, bake oven and testing stand.

§ § §

### GUSTAVE A. LARSON, U. S. A.

GUS LARSON, Madison, Wis., who is well-known for his refrigeration parts supply houses operating at Madison, Oshkosh and Milwaukee, Wis., as well as Rockford, Ill., had an experience on his return trip from the R.S.E.S. Convention in Buffalo that he will remember for some time.

Gus thought that his trip home would provide an opportunity to visit Canada, and found that it was a comparatively simple matter to leave the United States, but when he endeavored to make his re-entry at De-

troit, he learned that such little details as citizenship papers might have some bearing in the matter.

Gus had the pleasure of remaining as a guest of Canada a day longer than he had anticipated, although he had promised Mrs. Larson he would arrive in Milwaukee at a certain time. Finally, after long distance phoning, he was able to convince Mrs. Larson that his excuse was legitimate, and it would be only a short time before he would be home.

Gus was finally able to produce the required papers, and felt greatly relieved upon his re-admission to the United States.

§ § §

### TEN WAYS TO KILL AN ORGANIZATION

DON'T go to the meetings.

If you do go, go late.

If the weather doesn't suit you, don't think of going.

If you do attend a meeting, find fault with the work of the officers and members.

Never accept an office, as it is easier to criticize than do things.

Get "sore" if you are not appointed on a

## The Velvet Action Of A PEERLESS EXPANSION VALVE Is Due To Superior Design

• A sure, steady movement makes Peerless the most advanced thermal expansion valve. The valve body can be placed in a temperature either higher or lower than the bulb temperature without affecting control. Valve is charged with refrigerant having same pressure-temperature characteristics as the refrigerant with which it is used. This causes a more constant superheat throughout entire temperature range. Try a Peerless and see the difference.

*Additional NEW valves and other NEW Peerless Products will be shown in Booths 116, 117 and 118, First All-Industry Exhibition, January 16-19, Hotel Stevens, Chicago.*

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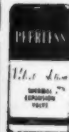
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committee, but if you are, do not attend the committee meetings.

If asked by the chairman to give your opinion on some matter, tell him you have nothing to say. After the meeting tell everyone how things should have been done.

Do nothing more than absolutely necessary, but when other members use their ability to help matters along howl out that the institution is run by a clique.

Hold back your dues or don't pay at all.

§ § §

## NEWS OF PAUL JACOBSEN

SOMETIME ago, we heard through that common source of information, "The Grapevine News Network" that Paul Jacobsen, of Marion, Ind., past national president, was a strong contender for the title of local pinochle champion. However, something must have happened to this race because now we receive the news that Paul has taken up the game of checkers. We are inclined to sympathize with Mrs. Jacobsen though in this new pastime, as we understand she is his most frequent opponent.

Incidentally, did you receive one of those Christmas checks sent out by Paul, which

were drawn on "The Bank of the Friends" paying to the order of the recipient "365 days of happiness?"

We thought it a clever idea, didn't you?

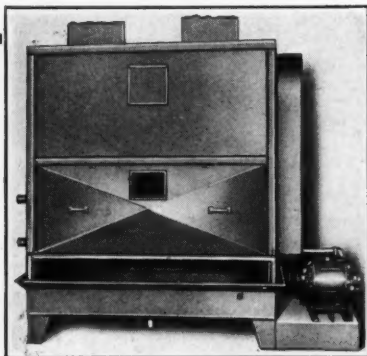
## Chapter Notes

Under this heading will appear news of the chapter meetings. For names of the officers and dates of regular meeting nights, please refer to the Chapter Directory.

### CHICAGO CHAPTER

December 13—While a short business session was conducted during the course of the evening, the main part of the time was devoted to social activities in which the ladies and many visitors took part. Mr. Fred Twiss opened the educational part of the evening by introducing Mr. V. C. Kelsey of the Accident Prevention Department of the Commercial Standard Insurance Co., who presented an interesting paper on the subject of safety and first aid as it concerns the refrigeration field. The paper was very much enjoyed by those in attendance and was very well presented.

Following this, the Imperial Brass Mfg.



# Marlo

## EVAPORATIVE REFRIGERATION CONDENSERS

Complete self-contained combination forced draft Cooling Tower and Condenser. Outdoor or indoor installation.

Particularly desirable in localities where water rates are high, ordinances restrictive, or drainage systems limited, because—

Marlo Evaporative Condensers save about 95% of water required for ordinary condensers which take water from city mains and waste it.

One-ton capacity and up.

Write for new Bulletin No. 394 giving full details, specifications and prices.

**MARLO COIL CO., 6135 Manchester Ave., St. Louis, Mo.**  
Manufacturers of Complete Line of Low Side Equipment

W-3R2

Co., represented by Mr. George Franck and Mr. Benson, conducted a tube bending contest. Ten members of the chapter took part and furnished a very amusing act of entertainment for the onlookers. There were eight prizes awarded, which had been donated by various jobbers and manufacturers, and were presented as follows:

Name	Time	Prize	Donor of Prize
1st—Herman Long .....	19 min.	Master Mechanic Set	Alro Supply Co., Chicago
2nd—Fred Roth .....	18.6 min.	1-ton A-P Valve	Automatic Prod. Co., Milwaukee
3rd—Percy Bossert .....	26.5 min.	Motor Bearing Puller Set	H. Channon Co., Chicago
4th—Otto Hladilek .....	22.4 min.	Serviceman Thermometer	Automatic Heating & Cooling Supply Co., Chicago
5th—Myer Axelrod .....	24.6 min.	Set of 12pt. Hexagon Sockets	Fred Roth, Chicago
6th—Fred Olds .....	27.3 min.	Kontanerette Set	H. Channon Co., Chicago
7th—Fred Twiss .....	26.7 min.	Ranco Control	Herman Goldberg Co., Chicago
8th—Ivar Skipple .....	48.1 min.	Gillette Safety Razor	Fred Roth, Chicago

Following the contest, a few acts of entertainment supplied by Mr. Herman Goldberg occupied the crowd for approximately one hour, which was followed with a short session of dancing. Mr. Goldberg then took over the evening with a showing of his movies taken at various R.S.E.S. functions. The first reel constituted views taken at the Illinois State convention and of a number of different jobbers' and service organizations' stores in Chicago. The second reel contained views of the national convention

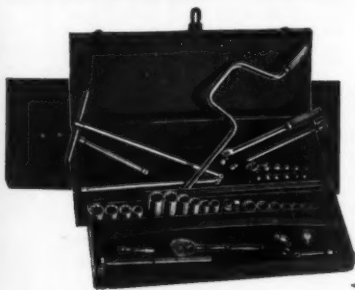
at Buffalo. The greater part of the showing was in colored film and we can readily appreciate the expense to which Mr. Goldberg has gone in taking these much appreciated pictures.

Following the movies there was dancing for the greater part of the evening, which was interrupted for a short time during

which a ladies' balloon-blowing contest was held. Winners of this contest were: 1st prize, Mrs. M. Koblisch, Oak Park; 2nd, Mrs. Loy, Chicago; 3rd, Mrs. Kempton, Chicago. Cash prizes were awarded to the three winners.

About 250 people enjoyed this full evening of entertainment, and the sincere thanks of the chapter are extended to those who contributed so much to it, with particular emphasis on Mr. George Franck and Mr. Benson of the Imperial Brass Mfg. Co.,

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Set includes 4 types of sockets  
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Available only through our own branch distributing warehouses located in 35 principal cities. See Snap-on Tools Corporation, in your telephone directory or write for catalog.

Mr. Herman Goldberg, and Mr. Ray Polley who kindly supplied the music.

### INDIANAPOLIS CHAPTER

*December 20*—The main part of the business this evening was devoted to the election of officers, which resulted in the following: *President*, Harold Klepfer; *1st Vice-President*, R. M. Duncan; *2nd Vice-President*, J. A. Salter; *Treasurer*, Leon Teeter; *Secretary*, E. W. Wulf; *Recording Secretary and Assistant Treasurer*, W. A. Steele; *Board of Directors*: J. O. Cummings, W. L. Drake, J. A. Cassady, R. K. Duncan, E. R. Claus.

Following this election, a party was held at the home of Mrs. J. A. Cassady, which proved to be a huge success.

To add to the spirit of the party, Mr. Cummings, who recently became the proud papa of a baby girl, obligated three new members.

### MISSOURI VALLEY CHAPTER

*November 17*—The Chairman of the Educational Committee introduced the guest speaker of the evening, Mr. Schenk of the Alco Valve Co. Mr. Schenk gave a very interesting lecture on refrigerant control, us-

ing slides to illustrate his points. A short recess was called during which time the members viewed the display of Alco Valve products in the room and then, using the glass evaporator as an illustrative example, Mr. Schenk explained the action of refrigerants and oil with the valve in various positions.

President Doyle thanked Mr. Schenk for bringing the glass evaporator to Omaha and for his able presentation of the subject.

Since there were so many visitors present, the President explained the aims and purposes of the R.S.E.S.

Following this, a short business session was held and Mr. Doyle, delegate to the national convention in Buffalo, gave a complete report of the proceedings.

*December 1*—After the usual business session of the evening, the Chairman of the Educational Committee introduced Mr. Nickols of the Gates Rubber Co., who gave an interesting talk on their products, using sections of the various types of belts for illustrations.

Mr. Hebden of the M. W. Dunton Co. was next introduced and described the Nokorode paste and solder.



## KRAMER

### "TRIPLE TROUGH" TEMPERATORS



### TRENTON AUTO RADIATOR WORKS - Trenton, N. J.

Showing typical installation of  
KRAMER Coils and "Triple Trough"  
Temperator Combinations at Elizabeth  
Food Beef Co., Elizabeth, N. J.

Both Mr. Hebden's and Mr. Nickols' talks were very much appreciated.

Announcement was made that at the next meeting election of officers for the coming year would be held. All members were urged to be present.

#### MISSISSIPPI VALLEY CHAPTER

December 9—President L. C. Nelson opened the meeting and immediately introduced the speaker of the evening, Mr. R. B. Barber of the Marathon Motor Co. During the course of his talk, Mr. Barber passed cigars to all members and also presented a box of cigars to Mr. Otto Balke for making the best suggestion of the evening when he stated that motors for refrigeration and oil burner work could have a manual cut-out with automatic relay feature. Mr. Barber gave a very interesting talk on new motors, which was much appreciated by the members. He has always been a welcome speaker at these meetings, and is one of the first speakers that Mississippi Valley Chapter ever had.

Plans were started and discussed for the third annual banquet and entertainment of Mississippi Valley Chapter, and the commit-

tee appointed was asked to have a report ready at the next meeting on December 19th.

Further discussion followed on the standardization of service rates among the service men.

#### TOLEDO CHAPTER

December 21—Considerable time was devoted to a discussion on ways and means of creating more interest in the chapter and obtaining a better attendance. Several good suggestions were made, one of which was that the Educational Committee set up a program which might be published covering the next twelve meetings so that each member may have a definite idea of what is coming.

A representative of the Kold-Hold Mfg. Co., was the guest speaker for the evening. He explained the principle of his product and the advantages of the Kold-Hold plate over the old brine system.

#### TRI-STATE CHAPTER

November 21—A short business session was dispensed with and Mr. Wheatley then read the paper, "Dryers and Drying Agents" which was presented at the national convention at Buffalo by Mr. V. E. Hall. A gen-

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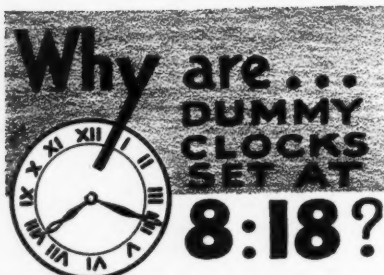
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## ELECTRIMATIC SUCTION THROTTLING VALVES

TEMPERATURE  
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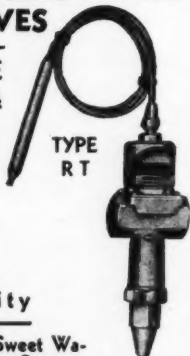
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eral discussion of this paper followed, with much good information being derived from the experiences of the individual members.

December 5—President C. Brunton appointed B. DeRoud, chairman, and J. Smoot and Donald Young, to the Nominating Committee, with instructions to select their choice of officers for recommendation at the following meeting.

At this time the meeting was turned over to Mr. Jack Dannels of the Cincinnati branch of the Fedders Mfg. Co., who showed an interesting film on the inspection of Fedders products in the course of their manufacture. The picture was very much enjoyed by the membership, and it was a pleasure to have Jack with us.

Next on the educational program was a study of the construction and operation of the Majestic hermetic unit which was illustrated through the use of a unit supplied by Secretary Albertsen.

### PITTSBURGH CHAPTER

December 19—Election of officers was held during the course of the evening, with the following results: *President*, E. V. Black; *Vice-President*, V. C. Waight; *Secretary-Treasurer*, F. V. Goltz; *Sergeant-at-Arms*, G. Croston; *Board of Directors*: J. Bargallo, J. C. Hipps and A. H. Ross.

On the educational program for the evening, a discussion of methods of selling service and remote installations was led by Mr. N. D. Wagener.

Mr. Black then appointed an auditing committee to consist of Mr. H. A. Biber, Paul Belec and S. A. Ricci.

### CENTRAL NEW YORK CHAPTER

November 14—After the usual minutes and reports had been read and a few discussions for the welfare of the chapter were disposed of, Mr. H. A. Persett, the delegate to the national convention at Buffalo, gave a complete report of the convention proceedings. Following this, announcement was made of the formation of a state association in the state of New York.

November 28—Mr. Charlie P. Rittling of the Fedders Mfg. Co. was a guest of the evening and was introduced to the group present.

Mr. Kelley of the American Injector Co. gave an interesting talk on his company's equipment.

Mr. Ray Coonradt announced his new connection with the Central Service Supply Co. of Syracuse, and introduced Mr. Ted

Glou, who spoke on his service to our community.

Refreshments were served at the end of the meeting.

#### ST. LOUIS CHAPTER

*November 10*—No provision was made for a speaker for the evening since considerable time was to be devoted to reports of the national convention. The meeting, therefore, was turned over to the delegates and to other members who had attended.

A very interesting story of the convention activities was outlined by the various members who had attended and such details as were overlooked were supplied by the Secretary, who also informed the members that the chapter had been successful in obtaining the 1939 convention.

The members were reminded that at least six or eight men to carry out the various parts of the convention program would be asked to volunteer for this work.

*December 8*—Although considerable difficulty was experienced by Educational Chairman E. Gygax in obtaining the films for this evening's entertainment, he finally succeeded. With Mr. Behrend operating the equipment, a film entitled, "The Story of Refrigeration" was presented for the benefit of those present.

At the conclusion of this showing, Mr. Gygax announced that at a future meeting the Ranco Company would have a representative present to give a talk on controls.

The balance of the evening was devoted mostly to ways and means of handling the forthcoming sixth annual convention.

Secretary E. A. Plesskott outlined the tentative committees and the work that would be assigned. He requested that members who felt they could handle these appointments make their wishes known.

#### DAYTON CHAPTER

*November 5*—Although it was the intention to devote this meeting to the installation of new officers, it was decided to postpone this feature to a later meeting due to the poor attendance.

After the usual session of business, the remainder of the evening was devoted to round table discussions.

*December 16*—To help the Educational Chairman in his work of presenting programs it was voted by those present that the Secretary purchase a blackboard to be used at the meetings.

Due to the fact that the former treasurer wished to retire from office, an election for

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**... and you've said Fit!**

\* Webster's New International Dictionary devotes 10¾ inches to describing "fit" as a noun, adjective, verb and adverb!

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**BOOTH 142**  
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**AIR - CONDITIONING**  
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 Stevens Hotel, Chicago, Jan. 16-19

a new treasurer was held, with the result that Mr. C. E. Spaugh was elected.

The installation of the new officers will be made at the next meeting to be held on January 6th.

#### WICHITA CHAPTER

*December 3*—After the regular order of business was dispensed with, the meeting was turned over to Mr. Govits, chairman of the Educational Committee, who introduced Mr. G. E. Roepke of the Alco Valve Co. Mr. Roepke showed a number of slides on automatic and thermostatic expansion valves, high side floats and float switches and then explained their operation and application. He then presented the Alco glass evaporator and explained the action of oil and refrigerants in the evaporator with different feeds from the expansion valve.

All members present felt this had been a very profitable evening, and a vote of thanks was extended to Mr. Roepke of the Alco Valve Co. for making the evening a success.

#### TRI-COUNTY CHAPTER

*December 9*—A lengthy report was given by Mr. Metcalf and Mr. Stafford on the

events at the national convention and at the same time announcement was made that the chapter had been honored with the election of one of its members—Willis Stafford—to the National Board of Directors.

A report of the chapter's recent Thanksgiving dance was given and this affair proved quite a success.

After some discussion it was decided that the annual meeting and election of officers would be held on January 6th at a meeting at the Woodruff Hotel in Joliet.

The Secretary was instructed to accept the Wagner Electric Company's representative as a speaker on motors at the January 20th meeting.

Further discussion on changes to the constitution and by-laws was tabled until after the election of officers.

A request was made that another dance be held on February 18th. Further discussion on the matter was deferred until a later date.

#### TRI-STATE LADIES AUXILIARY

A meeting of the auxiliary was held at the home of Mrs. A. W. Albertsen on December 5th, presided over by Mrs. June Brunton.

### At the Chicago Show

We invite all Canadians  
 at the R. & A. C. Exhibition  
 Jan. 16-19 to visit us at  
 Canadian headquarters in  
 the Stevens Hotel.

**REFRIGERATION**  
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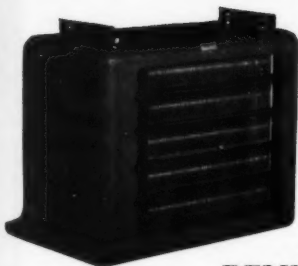
This device is the only means of determining whether or not a Capacitor is defective. Turning the mfd. selector determines what size is necessary for replacement. The test box may be left in the circuit while a replacement is secured.



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The business of the evening was dispensed with.

After the business session, the game of Chinker Checks was enjoyed, and refreshments were served by the hostess of the evening.

Plans were started for a Christmas party to be held at the home of Mrs. M. E. Harrison of Ashland, Kentucky, on December 27th. Invitations are to be sent to all members of the Tri-State Chapter and their families.

\*\*\*

### NEW PINCH-OFF TOOL TAKES THE FORM OF PLIERS

As a contribution to the safety of the refrigeration service industry a new pinch-off tool has been designed and is being distributed through refrigeration jobbers by Refrigeration Service, Inc., 3109 Beverly Blvd., Los Angeles, California.

The tool, known as the Vise-Grip Pinch-Off Pliers, uses the already well known Vise-Grip Wrench principle with special rounded jaws which will instantly pinch refrigeration tubing from 3/16 to 1/2 inch.

The mechanism is such that when the

plier is snapped onto the tube, a gas tight pinch results, the tool holding onto the tube by itself until released by opening the handles. Pinches made with the Vise-Grip provide a maximum tube area when opened again.

The Vise-Grip Pinch-Off Pliers was originally designed as an emergency tool, to be carried in the serviceman's pocket, instantly available in case of line breaks or gas leaks.

Additional information may be obtained from leading jobbers or from Refrigeration Service, Inc.

\*\*\*

### J. L. SHRODE OF ALCO VALVE CO. PASSES AWAY

J. L. SHRODE, president and founder of the Alco Valve Company, manufacturers of automatic control equipment, died December 31st at 10 p.m. from a cerebral hemorrhage. Mr. Shrode was 58 years old.

Mr. Shrode invented and patented an automatic constant pressure type expansion valve in 1924. In 1925 after the patent was issued Mr. Shrode formed the Alco Valve Company which was incorporated September, 1927 and has since been its president.

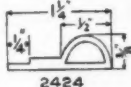
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Customers in 37 states had hermetically sealed units rebuilt or exchanged by us in the past year. Complete factory equipment for precision rebuilding. One year guarantee on all rebuilt units. Exchange service available on most makes and models. Write for prices and descriptive literature.

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About twenty-one years ago, Mr. Shrode entered the refrigeration industry with the Isko Company. Prior to that time he had worked on the installation of power and ice plants. Leaving Isko he became district sales manager for the Lipman Refrigerator Car and Mfg. Company of Beloit, Wisconsin.

Mr. Shrode was a member of the Rotary Club, the Lions Club, was a 32nd degree Mason, member of ASRE since 1931, past chairman of St. Louis Section, member of Engineer Council of St. Louis. He was an amateur magician of standing—in his youth he spent two years with Howard Thurston.

§ § §

## AIRO SUPPLY COMPANY ISSUES NEW CALENDAR

**A**NOTHER of the "He Tried To Do It Himself" series of cartoons has just been released by the Airo Supply Company of Chicago. The picture this year humorously illustrates what happens when a butcher tries to repair his own refrigeration equipment.

This form of promotional activity is in-

tended to assist servicemen in securing more business by impressing all users of refrigeration equipment with the fact that servicing, overhauling, adjusting, etc., should be entrusted only to well-trained servicemen.

The latest illustration of "He Tried To Do It Himself" is reproduced on the 1939 Calendar distributed to servicemen and dealers by the Airo Supply Company. Calendars may be obtained by writing the Airo Supply Company, 2732 North Ashland Avenue, Chicago, Illinois, on your letterhead or enclose a business card, statement, etc., to identify your connection with the refrigeration and air conditioning industry.

§ § §

## HARRY ALTER TO DISCONTINUE APPLIANCE DIVISION

**T**HE Harry Alter Company announces that arrangements have been completed to discontinue the handling of all major appliances which were formerly distributed by them. From now on they will devote all their time exclusively to the distribution of refrigeration parts, supplies, tools and equipment.

## SHIPPED THE SAME DAY

BABBITT  
BRONZE BEARINGS  
BRONZE BUSHINGS  
BRONZE HAMMERS  
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**Out February 1st**

Write for your copy today . . . Fin coils of copper, aluminum and steel . . . "Thermo" Fin in Tube . . . Blowers . . . Ice Cube Makers . . . Cascade Drip Pans . . . Bare Tube Coils . . . Estimates promptly furnished, no charge.

**MANUFACTURERS FIN COIL CO., 2505-7 So. Pulaski Rd., Chicago**

Mr. Arthur Alter, formerly the head of the Appliance Division will take over the Sales Management of the parts and supplies. Mr. Max Geisler, formerly Sales Promotion Manager in the Appliance Division will handle all of the advertising and catalog work. Mr. Joe Novotny has been appointed Purchasing Agent. Mr. Irving Alter will continue as Merchandise Manager. In making the announcement Mr. Irving Alter states—"We have just completed revising and consolidating our offices and adding to our stockroom and Shipping Department. With our new facilities and more efficient layout, we are in a better position to handle shipments than ever before.

"Mr. Arthur Alter will be in charge of the management of our branches. We have one branch in New York, managed by Mr. George Munzer, one branch in Cleveland, managed by Mr. Henry Spivak, and one branch in St. Louis, managed by Mr. B. F. Anthony. We also have three branches in Chicago under the management of Mr. Harry Bernhardt at the North Side branch, Mr. Joe Holub at the West Side Branch, and Mr. Steve Majeski at the South Side Branch."

## ROTARY SEAL REPLACEMENT UNITS FOR 1939

IN accordance with their principal objective—that of keeping their line of replacement seal units for refrigeration compressors up to the requirements of the trade—the Rotary Seal Company has announced the addition of twenty-three new Rotary Seal Replacement Units for 1939. This brings the number of stock units available to one hundred and fifteen covering practically every make of refrigeration compressor now in use. Besides this increase, the Rotary Seal Replacement Units for 1939 will include numerous new features in construction which, it is claimed, make them even more than ever before the ideal method of overcoming compressor shaft leaks.

It has been the practice of this company's sales and engineering departments to check closely with the service men in the field regarding the ease of installation and the details of design and construction of Rotary Seal Replacement Units and their comments and suggestions carefully noted. The information thus obtained in addition to that

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compiled from the extensive laboratory tests has been very instrumental in producing just what the service engineer demands.

Approximately two years ago the Rotary Seal Company put on the market a replacement seal unit known as their KF-1505. The seal ring design used varied somewhat from that used in their other units. Theoretically this modified design had numerous advantages but an extensive field test was

desired to confirm the theory and laboratory tests. Now after two years of use during which time the KF-1505 Rotary Seal has become an accepted item for service engineers throughout the world, this same design is being used in most of the remaining units. In addition to this change, numerous refinements making the installation of any unit practically fool-proof have been incorporated. Instruction sheets also have been rewritten to provide a very clear and simple procedure for the service man to follow.

The new stock list now being distributed to refrigeration replacement parts jobbers lists information which will be very helpful when deciding which Rotary Seal unit is required for a particular compressor. Production on the new units has already started and it is expected that all of the one hundred and fifteen items will be available to the trade about the middle of January.

§ § §

### **METAL BINS FOR YOUR SMALL PARTS**

**A** NEAT, compact, efficient and low cost means for keeping track of screws, bolts, nuts, washers, rivets, staples, pins, brads, and the innumerable small parts required in the manufacture, installation and servicing of refrigerators is provided by Add-A-Bin.

This is a system of unit bins sold separately and assembled by the user to fit his individual needs. The bin housing may be screwed to a wall, bench or cupboard, or to a panel which may be fashioned into a portable kit. A bin may be opened for removal of a single item and it is so delicately balanced that the weight of its contents, no

## You NEED This

This HEAD PRESSURE CALCULATOR gives you HEAD PRESSURES for ANY air cooled installation using SO<sub>2</sub>, Methyl, or F-12.

Price \$1.25. See your  
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matter how light, causes it to close automatically when the mechanic's hand is removed. If, when open, the bin is lifted slightly, it will lock open; or it may be lifted higher, pulled out and down and remains open horizontally for cleaning; or it may be removed entirely from the housing. Some mechanics mount Add-A-Bin assemblies on either side of a vertical board, provide it with a wood base and a handle and they have a parts kit which they take to the



**METAL BINS FOR SMALL PARTS**

job just as they do a tool kit. This saves a lot of running back to the bench.

Add-A-Bin units are made in two series, which may be assembled as shown or in any other desired combination or shape. The 3-inch bins are all 2½ inches deep, 3 inches high and 3 inches, 6 inches or 9 inches wide. The 4-inch bins are all 3 inches deep, 4 inches, 8 inches or 12 inches wide. They are of welded construction.

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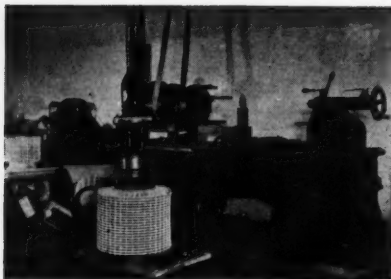


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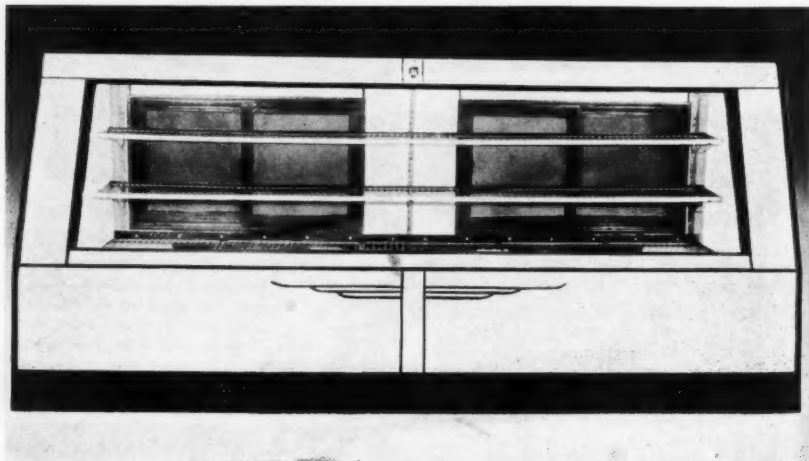
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Our experience in manufacturing display cases during the past three years for one of the leading refrigeration companies has been invaluable. Midwest cases have been shipped from coast to coast, and from the Canadian border to the Gulf. We know what is required to build cases for all climates and conditions. We know where quality must be maintained. We know where to stop in trying to cut costs of materials.

The Midwest line of display cases is a "quality" line. We are not trying to compete with the low price brackets. However, due to our complete manufacturing facilities, which are second to none in the commercial refrigeration industry, and due to the fact



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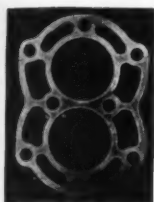
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that we have one line instead of several, our manufacturing costs are kept at a minimum—thereby enabling us to offer a "Deluxe" line of cases at prices only slightly more than the low priced cases.

The 100 percent porcelain feature is only one of many. There are others which our literature covers in detail. Briefly, the other features include composite steel and wood construction, full thickness of an insulating material which Midwest pioneered in the commercial refrigeration industry four years ago and which has since been adopted by several of the leading commercial refrigeration manufacturers—Balsam Wool. Efficient coiling and baffling of Midwest cases is backed by a year of intensive research work. Our coils are not the cheapest, but they are the best. Triple plate glass is scientifically glazed to prevent fogging and sweating. The finest of hard rubber doors have been selected with the latest features and design.

The Midwest line will consist of 6, 8, 10 and 12 ft. double duty meat cases, 6, 8 and 10 ft. double duty, three-shelf, delicatessen models, and 10 and 12 ft. single duty meat display models.

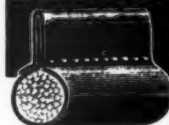
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**THE** Turner Brass Works, Sycamore, Illinois, announce that recent developments make their Halide Detectors (No. H-1 and No. H-15) super-sensitive in locating tiniest leaks of chlorinated hydrocarbon refrigerants. Instantaneous clearing of the flame even when a heavy leak is encountered is another advantage of these improvements. The prices remain the same. Complete information on these improved models may be secured by writing the manufacturer.

SERVICE ENGINEER

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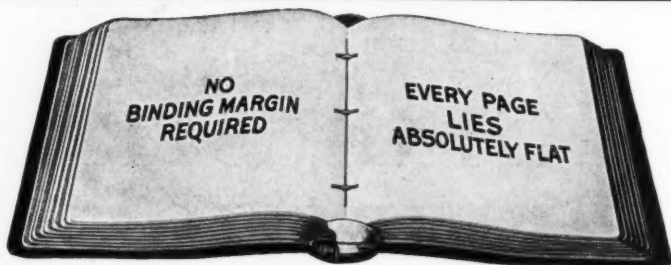
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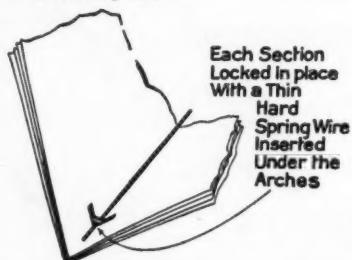
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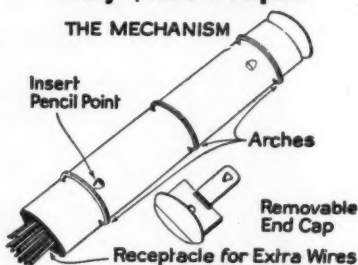
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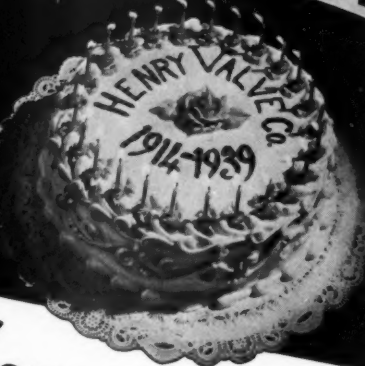
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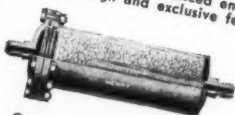
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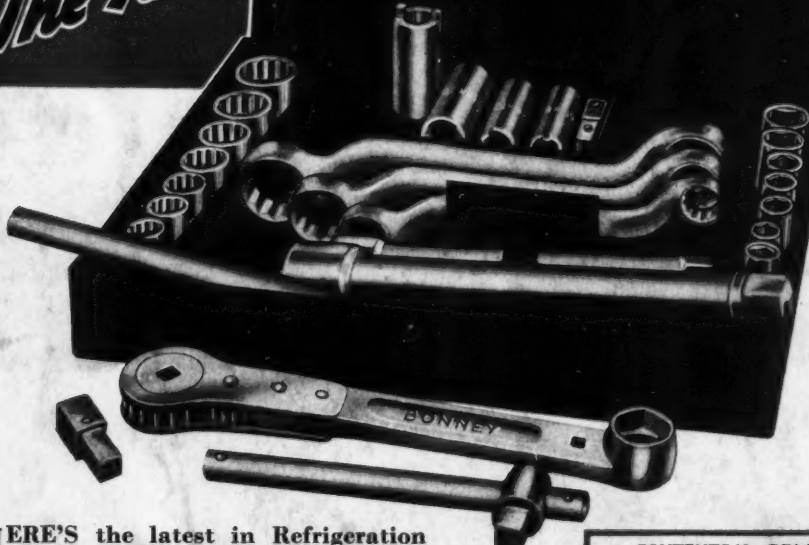
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